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User Manual

Tektronix

TDS 340, TDS 360 & TDS 380
Digital Real-Time Oscilloscopes

070-9459-01

CE

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TO John Martin 94-540 DATE June 25, 1991

FROM Frank Gray, 50-PAT

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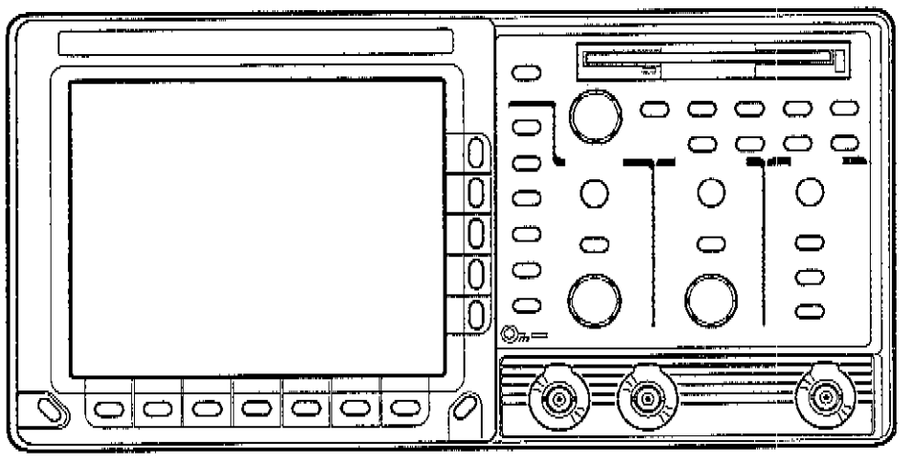
Getting Started



Tektronix TDS 340, TDS 360, and TDS 380 oscilloscopes are digital signal processors and are superb tools for displaying and measuring waveforms. Their performance addresses the needs of both benchtop lab and portable applications with the following features:

- Two input channels, each with a record length of 1,000 samples and 8-bit vertical resolution. Both channels acquire waveforms simultaneously.
- 2 Gigasample/second maximum sample rate (TDS 380); 1 Gigasamples/second maximum sample rate (TDS 360); 500 Megasamples/second maximum sample rate (TDS 340).
- 400 MHz analog bandwidth and fastest time base setting of 2.5 ns/div (TDS 380); 200 MHz analog bandwidth and fastest time base setting of 2.5 ns/div (TDS 360); 100 MHz analog bandwidth and fastest time base setting of 5 ns/div (TDS 340).
- A full complement of advanced functions including on-screen readout, AUTOSET, cursors, continuously updated automatic measurements, and FFT.
- Waveform averaging, waveform enveloping, and hardware peak detection.
- Floppy disk drive (TDS 380 and TDS 360) for mass storage of waveforms, setups, and hard copies.
- A unique graphical user interface (GUI) and a logical front-panel layout which combine to deliver the standard in usability pioneered by the TDS family of oscilloscopes.

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Start Up

To properly install and power on the oscilloscope, perform this procedure.

1. Check that you have the proper electrical connections. The rear label lists power requirements for all possible voltage inputs.
2. Check the fuse to be sure it is the proper type and rating (Figure 1–2). TDS 300 Series oscilloscopes are shipped with a UL-approved fuse installed.

   Fuse specifications are as follows:
   5 mm × 20 mm, time-lag, 3.15 A, 250 V, or
   1.25 in × 0.25 in, time-lag, 3 A, 250 V
3. Connect the proper power cord from the rear-panel power connector (Figure 1–2) to the power system. Use the power cord clamp to secure the cord to the rear panel.
4. Leave space for cooling. Do this by verifying that the air-intake and exhaust holes on the sides and bottom of the cabinet (where the fan operates) are free of any airflow obstructions. Leave at least 5.1 cm (2 in) free on each side.
5. Press the ON/STBY button to power up the oscilloscope (see Figure 1–1).

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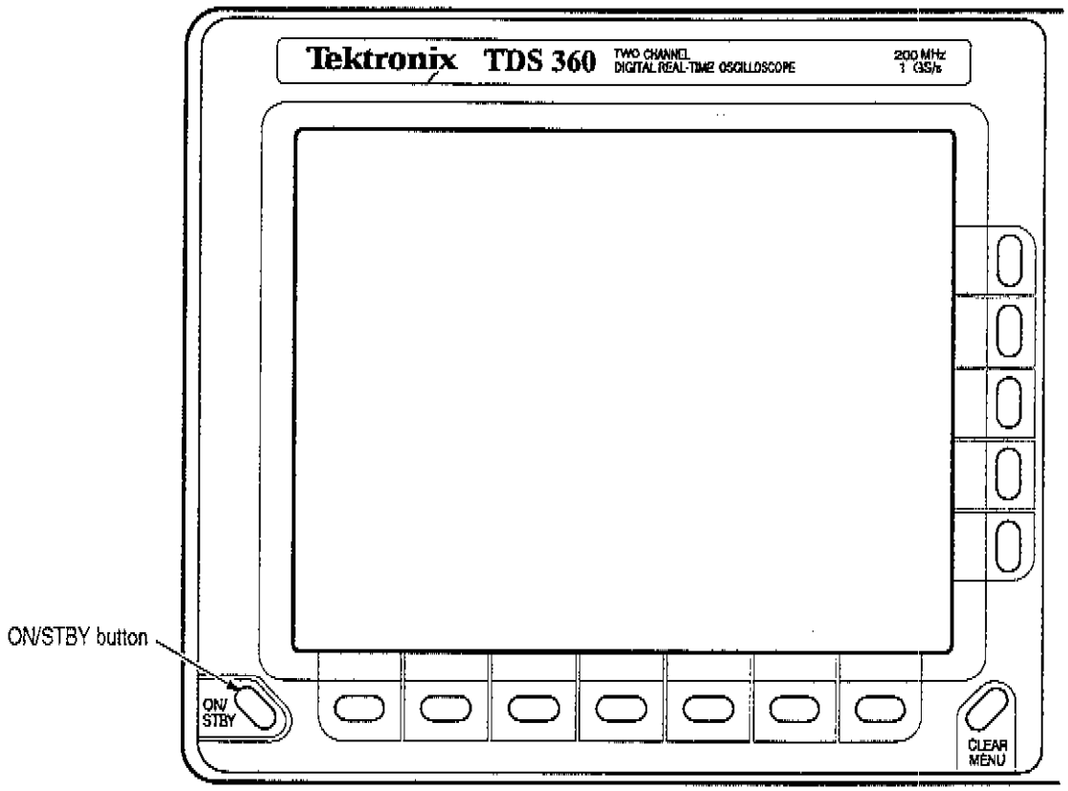

Figure 1–1: The ON/STBY button

Line Fuse Replacement

WARNING. *To avoid injury or death, unplug the line cord from the line voltage power source before continuing.*

1. Have handy a flat-bladed screwdriver.
2. Set the oscilloscope so its bottom is down on the work surface and its rear is facing you.
3. Find the line cord on the rear cover. (See Figure 1–2.) Unplug the line cord from its receptacle.
4. Find the fuse drawer beneath the line-voltage plug on the rear panel. Now, pry open the drawer with a small flat-bladed screwdriver, and remove the line fuse. (See Figure 1–2.)

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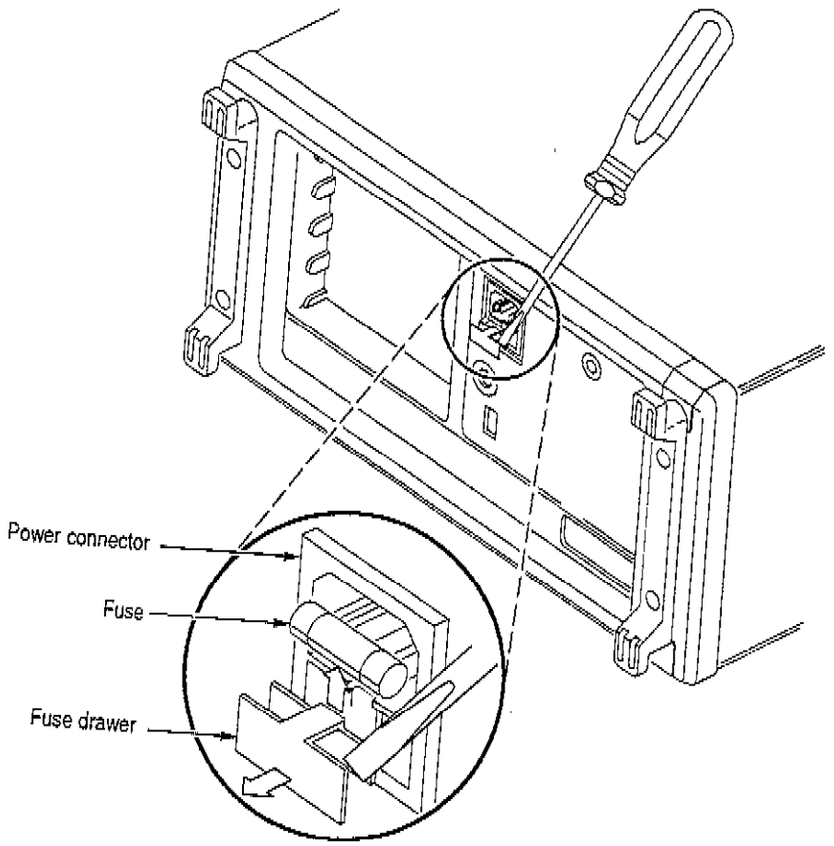

Figure 1–2: Line fuse removal

5. *Reinstallation:* Do in reverse steps 4 through 2 to reinstall the line fuse and then the line cord.

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Self Test

This procedure uses internal routines to verify that the oscilloscope functions and passes its internal self tests and signal-path compensations. It also confirms that the oscilloscope was adjusted properly at the time it was last adjusted. No test equipment or hookups are required.

Equipment Required: None.

Time Required: Approximately 5 minutes.

Prerequisites: Power up the oscilloscope and allow a 20 minute warm up before doing this procedure.

Procedure:

1. Press the front-panel button UTILITY.
2. Press the main-menu button System to select Diag.
3. Press the main-menu button Execute and then press the side-menu button OK Confirm Run Test. The internal diagnostics verify proper oscilloscope function. This verification takes about 30 seconds. While it progresses, a variety of test patterns flash on screen. When finished, status messages appear on the screen.
4. Check that the screen reports no failures. If it reports a failure, the oscilloscope has failed the self test. Contact your Tektronix representative for assistance.
5. Press CLEAR MENU.
6. Press UTILITY and then press the main-menu button System to select Cal.
7. Check that the word Pass appears in the main menu under the Voltage Reference, Timing, and Ext Trig menu labels. (See Figure 1–3.) If any of the labels read Fail, the oscilloscope has failed the self test. Contact your Tektronix representative for assistance.

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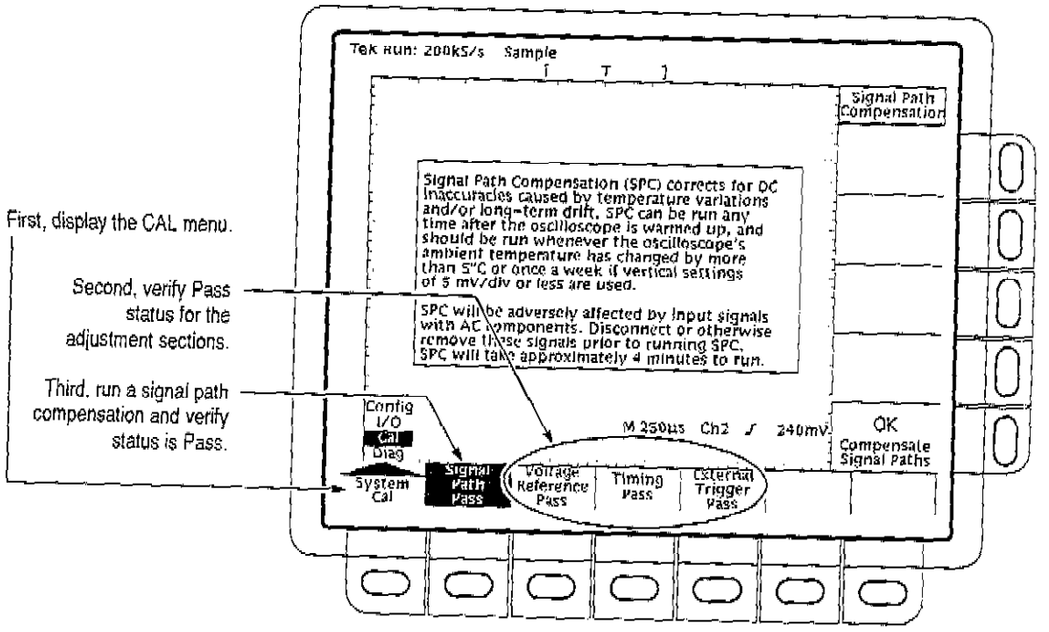
First, display the CAL menu.
Second, verify Pass status for the adjustment sections.
Third, run a signal path compensation and verify status is Pass.
Tek Run: 200kS/s Sample
Signal Path Compensation
Signal Path Compensation (SPC) corrects for DC inaccuracies caused by temperature variations and/or long-term drift. SPC can be run any time after the oscilloscope is warmed up, and should be run whenever the oscilloscope's ambient temperature has changed by more than 5°C or once a week if vertical settings of 5 mV/div or less are used.
SPC will be adversely affected by input signals with AC components. Disconnect or otherwise remove these signals prior to running SPC. SPC will take approximately 4 minutes to run.
Config I/O
Cal
Diag
System Cal
Signal Path Pass
Voltage Reference Pass
Timing Pass
External Trigger Pass
M 250µs Ch2 ƒ 240mV
OK Compensate Signal Paths

Figure 1–3: Verifying adjustments and signal path compensation

8. Press Signal Path and then press the side menu button OK Compensate Signal Paths. When compensation completes, the status message updates to Pass or Fail in the main menu

9. Check that the word Pass appears under Signal Path in the main menu. (See Figure 1–3.) If Pass does not appear, the oscilloscope has failed the performance verification; return it to Tektronix for servicing.

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Functional Test

The purpose of this procedure is to confirm that the oscilloscope functions properly.

NOTE. *This procedure verifies functions; that is, it verifies that oscilloscope features operate. It does not verify that they operate within limits. Therefore, when the instructions that follow call for you to verify that a signal appears on-screen "that is about five divisions in amplitude" or "has a period of about six horizontal divisions," do NOT interpret the quantities given as limits. Operation within limits is checked in the performance tests, which begin on page B–5.*

DO NOT make changes to the front-panel settings that are not called out in the procedure. If you make changes to these settings other than those called out in the procedure, you may obtain invalid results. In this case, just redo the procedure from step 1.

Equipment Required: One P6109B (TDS 340), P6111B (TDS 360), or P6114B (TDS 380) probe.

Time Required: Approximately 5 minutes.

Prerequisites: None.

Procedure:

1. Install the probe on CH 1. Connect the probe tip to PROBE COMP on the front panel; leave the probe ground unconnected. (See Figure 1–4.)

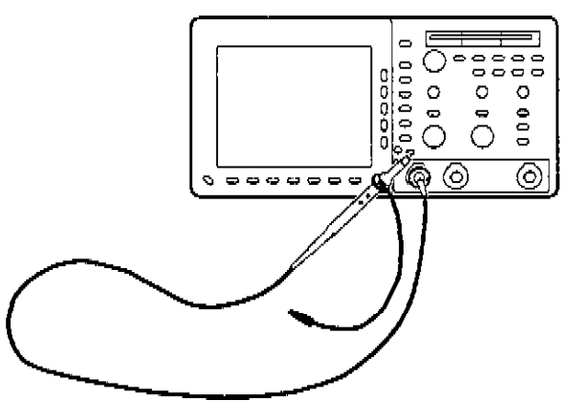

Figure 1–4: Hookup for functional test

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2. Press the front-panel button SAVE/RECALL, the main-menu button Recall Factory Setup, and then the side-menu button OK Confirm Factory Init.
3. Press AUTOSET.
4. Set the VOLTS/DIV to 1 V. Use the vertical POSITION knob to center the waveform vertically on screen.
5. Set the SEC/DIV to 250 µs.
6. Check that a square wave probe-compensation signal of about five divisions in amplitude is on screen.
7. Check that one period of the square wave probe-compensation signal is about four horizontal divisions on screen.
8. Check that the horizontal POSITION knob positions the signal left and right on screen when rotated.
9. Press the front-panel button TRIGGER MENU, the main-menu button Mode, and then the side-menu button Normal.
10. Check that the trigger-level readout for the main trigger system changes with the trigger LEVEL knob.
11. Check that the trigger-level knob can trigger and untrigger the square-wave signal as you rotate it. (Leave the signal *un*triggered.)
12. Check that pressing SET LEVEL TO 50% triggers the signal that you just left untriggered.
13. Press the front-panel button ACQUIRE, the main-menu button Mode, and then the side-menu button Sample.
14. Check that the oscilloscope displays an actively acquiring waveform on-screen. (Note that there is noise present on the peaks of the square wave.)
15. Press the side-menu button Peak Detect. Check that the oscilloscope displays an actively acquiring waveform on screen with the noise "peak detected."
16. Press the side-menu button Envelope. Check that the oscilloscope displays an actively acquiring waveform on screen with the noise displayed.
17. Press the side-menu button Average. Check that the oscilloscope displays an actively acquiring waveform on screen with the noise reduced.
18. Press WAVEFORM OFF to remove Channel 1 from the display.
19. Press CH 2 and move the probe to the CH 2 input.
20. Repeat steps 3 through 17 for Channel 2.

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21. Disconnect the probe from the channel input and the PROBE COMP terminal.

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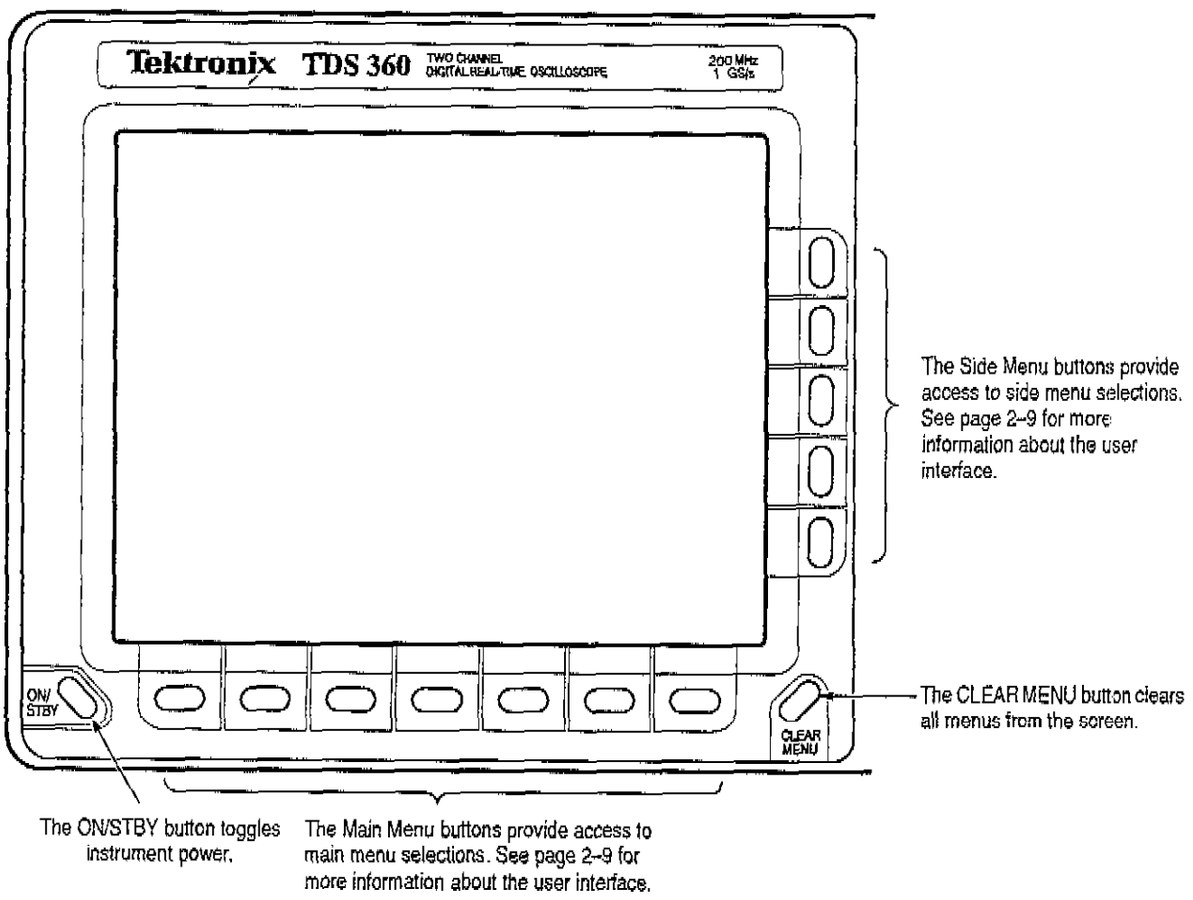
Operating Basics

This chapter begins with eight illustrations that identify and describe each control and connector on the TDS 300 Series oscilloscope. Next, *Operating Basics* covers these additional topics:

- Using the menu system
- Using probes
- Using autoset

Display and Power Controls


Tektronix TDS 360 TWO CHANNEL DIGITAL REAL-TIME OSCILLOSCOPE 200 MHz 1 GS/s
ON/ STBY
CLEAR MENU
The Side Menu buttons provide access to side menu selections. See page 2–9 for more information about the user interface.
The CLEAR MENU button clears all menus from the screen.
The ON/STBY button toggles instrument power.
The Main Menu buttons provide access to main menu selections. See page 2–9 for more information about the user interface.

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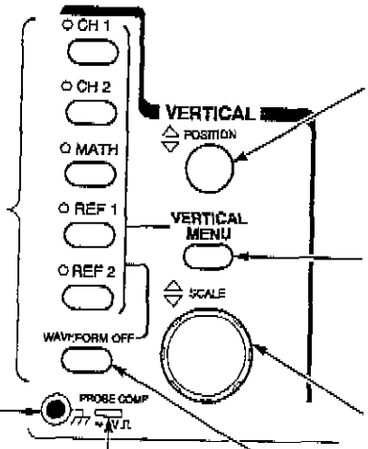
Vertical Controls



The Waveform Select buttons display and select waveforms (CH1, CH2, MATH, REF1, and REF2). A light next to a button illuminates when that waveform is selected.

The Vertical POSITION knob controls the vertical position of the selected waveform.

The VERTICAL MENU button calls up the vertical operations menu. For more information about vertical operations, see page 3–3.

The SCALE knob controls the vertical scale of the selected waveform.

The WAVEFORM OFF button turns off the selected waveform.

Connector to chassis ground.

Probe compensation output. See page 2–12 for instructions on how to compensate the probes.

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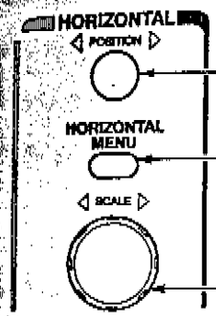
Horizontal Controls



The Horizontal POSITION knob controls the horizontal position of all waveforms.

The HORIZONTAL MENU button calls up the horizontal operations menu. For more information about horizontal operations, see page 3–6.

The SCALE knob controls the horizontal scale of the active waveforms.

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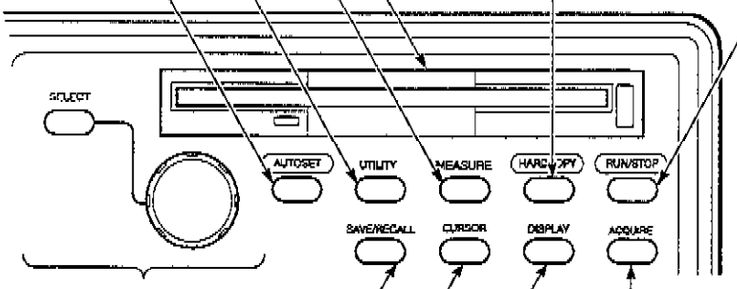
Miscellaneous Controls



The MEASURE button calls up the automated measurements menu. See page 3–17 for more information about automated measurements.

The UTILITY button calls up the utility menu. See page 3–59 for more information about utilities.

The floppy disk drive provides mass storage for waveforms, setups, and hard copies.

The RUN/STOP button starts and stops acquisition.

The AUTOSET button automatically sets up the instrument to produce a usable display of the input signals. See page 2–15 for more information about the autoset function.

The HARDCOPY button starts print operations. See page 3–41 for more information about making hard copies.

The General Purpose Knob controls many side-menu functions, including the cursors. The SELECT button switches control from cursor to cursor.

The ACQUIRE button calls up the acquisition menu. See page 3–25 for more information about controlling acquisition.

The SAVE/RECALL button calls up the save/recall menu. See page 3–45 for more information about saving and recalling waveforms. See page 3–51 for more information about saving and recalling setups.

The CURSOR button calls up the cursor menu. See page 3–21 for information about making measurements with cursors.

The DISPLAY button calls up the display menu. See page 3–27 for information about controlling the display.

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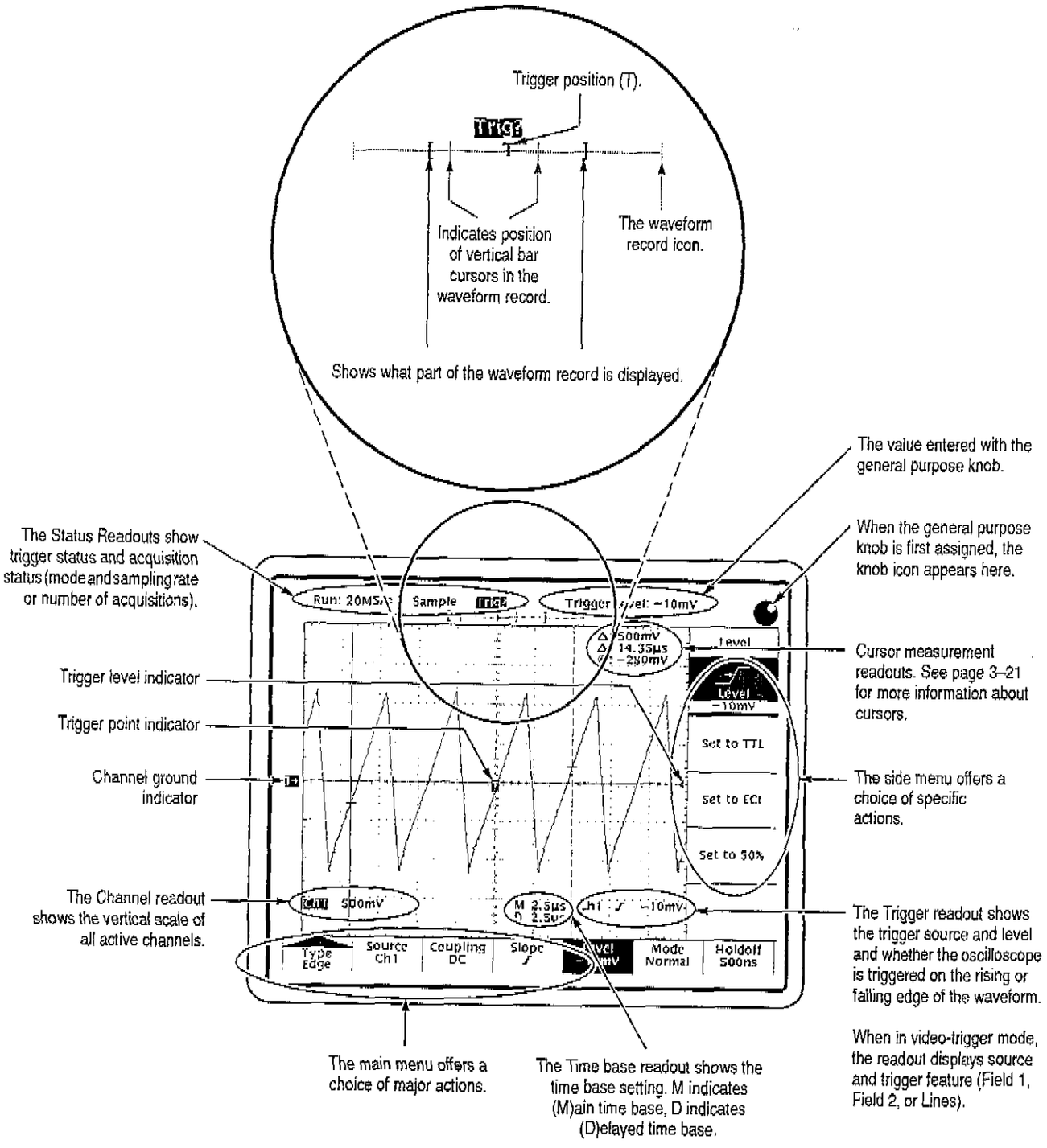
Display Map


Trigger position (T).
TRIG
Indicates position of vertical bar cursors in the waveform record.
The waveform record icon.
Shows what part of the waveform record is displayed.
The value entered with the general purpose knob.
When the general purpose knob is first assigned, the knob icon appears here.
The Status Readouts show trigger status and acquisition status (mode and sampling rate or number of acquisitions).
Trigger level indicator
Trigger point indicator
Channel ground indicator
The Channel readout shows the vertical scale of all active channels.
Cursor measurement readouts. See page 3–21 for more information about cursors.
The side menu offers a choice of specific actions.
The Trigger readout shows the trigger source and level and whether the oscilloscope is triggered on the rising or falling edge of the waveform.
When in video-trigger mode, the readout displays source and trigger feature (Field 1, Field 2, or Lines).
The main menu offers a choice of major actions.
The Time base readout shows the time base setting. M indicates (M)ain time base, D indicates (D)elayed time base.
Run: 20MS/s Sample
Trigger level: −10mV
Level
Level −10mV
Set to TTL
Set to ECL
Set to 50%
Type Edge
Source Ch1
Coupling DC
Slope
Mode Normal
Holdoff 500ns

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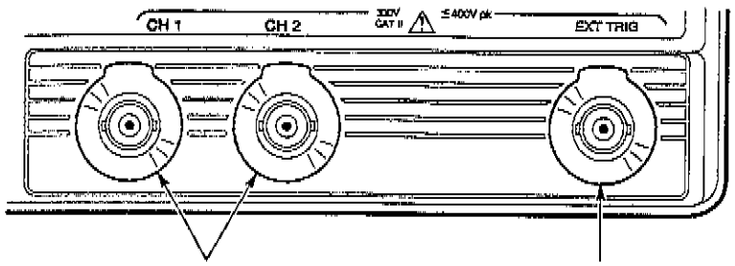
Inputs



The channel BNC inputs (CH1 and CH2) accept electrical signals for display.

The EXT TRIG input accepts external trigger signals. See page 3–12 for more information about external triggering.

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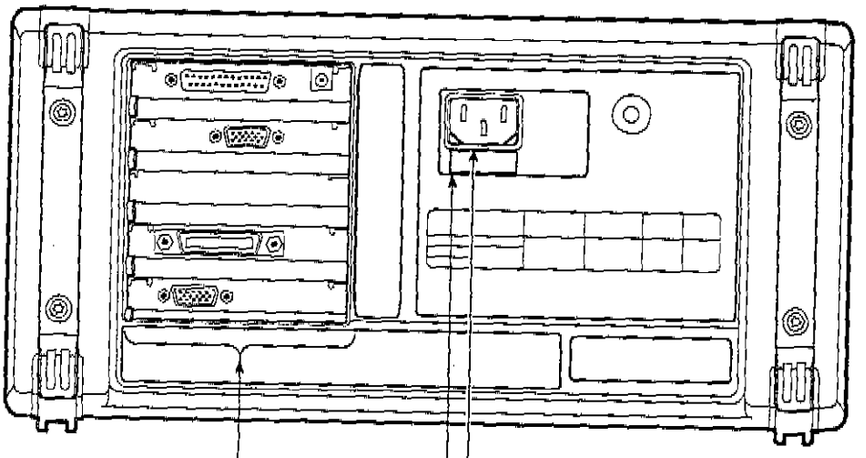
Rear-Panel Connectors



The Option 14 Panel (Option 14 instruments only) allows access to three communications interfaces: a Centronics parallel port, an RS-232 interface, and a GPIB interface. It also includes a VGA video-compatible output port and a power connector for the optional TDS4F5P printer upgrade kit.

You can use the Centronics, RS-232, and GPIB interfaces to transmit hardcopy data; see page 3–41 for hard copy procedures.

You can use the GPIB and RS-232 interfaces to operate and program the oscilloscope from a GPIB controller; see the *TDS 340, TDS 360 & TDS 380 Programmer Manual* for more information.

The power connector accepts line voltage to power the instrument. See page C–1 for a list of power cord and connector options.

The fuse drawer holds the line fuse. See page 1–3 for fuse replacement procedures.

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Using the Menu System

TDS 300 Series oscilloscopes use an intuitive user interface. This interface reduces front-panel clutter while allowing easy access to specialized functions through the menu structure.

The procedure on page 2–10 illustrates how to navigate in the menu structure. If you are unfamiliar with this menu system, you may want to run through the procedure several times to learn how you can access functions and subfunctions. Refer to Figure 2–1 as necessary.

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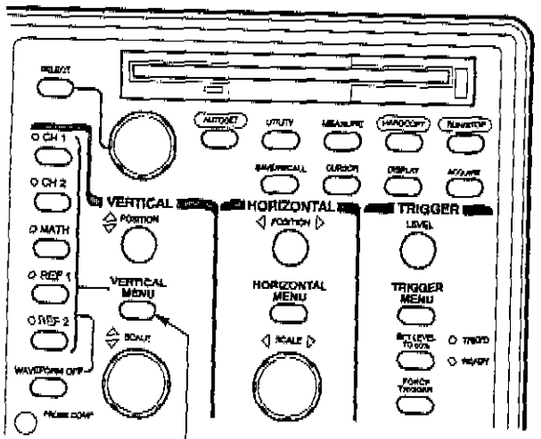
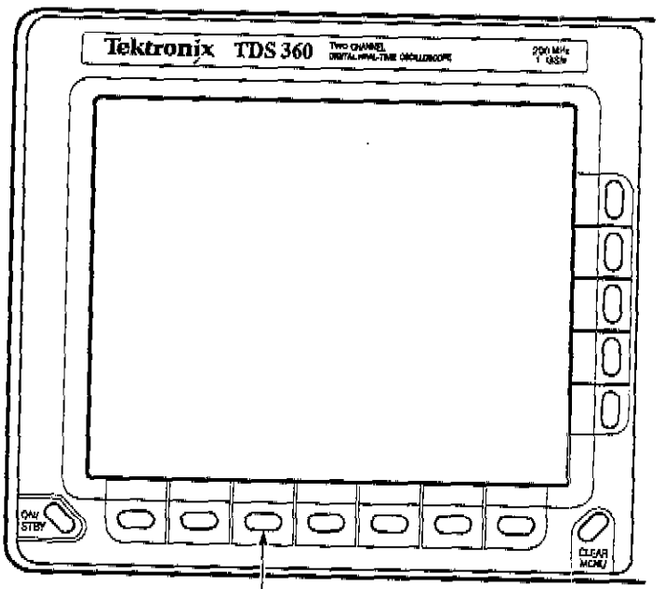
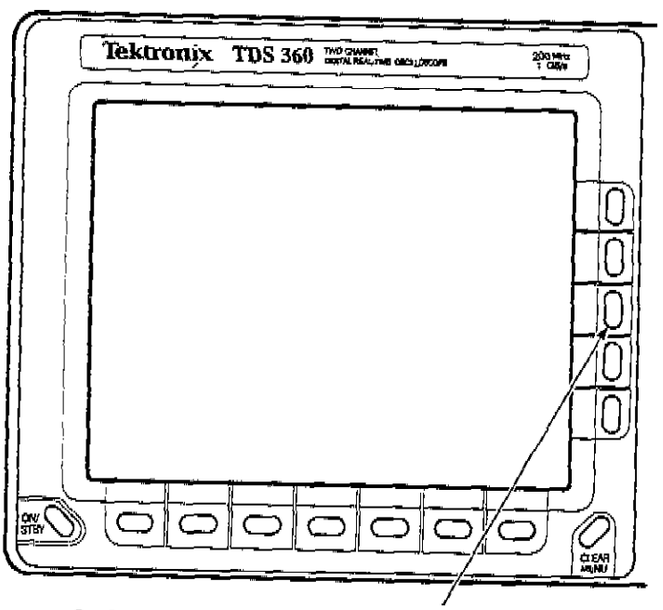


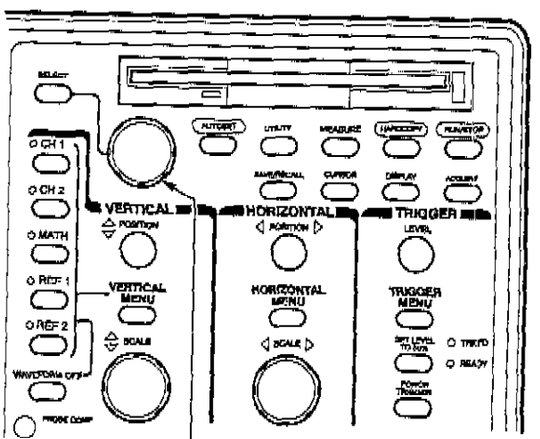
1 Press any of the front-panel menu buttons.



2 Select an item from the main (bottom) menu or use leftmost button to pop up selections.



3 Select an item from the side menu, if displayed.



4 Adjust menu item values with general purpose knob.

Figure 2–1: Using menus

1. Push one of the indicated front-panel buttons to call up a menu of functions. This first menu is the *main menu*. Sometimes the main menu will be a side menu (step 3), but most main menus are bottom menus.

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2. Push a bottom menu button to select a function. One of three things result:

   - If the function has no subfunctions, it becomes active. If it is a variable function, you can now use the General Purpose Knob to adjust it (step 4).
   - If the function has subfunctions, they appear on the side menu (step 3).
   - The leftmost bottom menu button sometimes activates a pop-up menu (as shown in Figure 2–2). You can cycle through the pop-up menu options by repeatedly pressing the button. Each selection calls up different bottom and side menus.

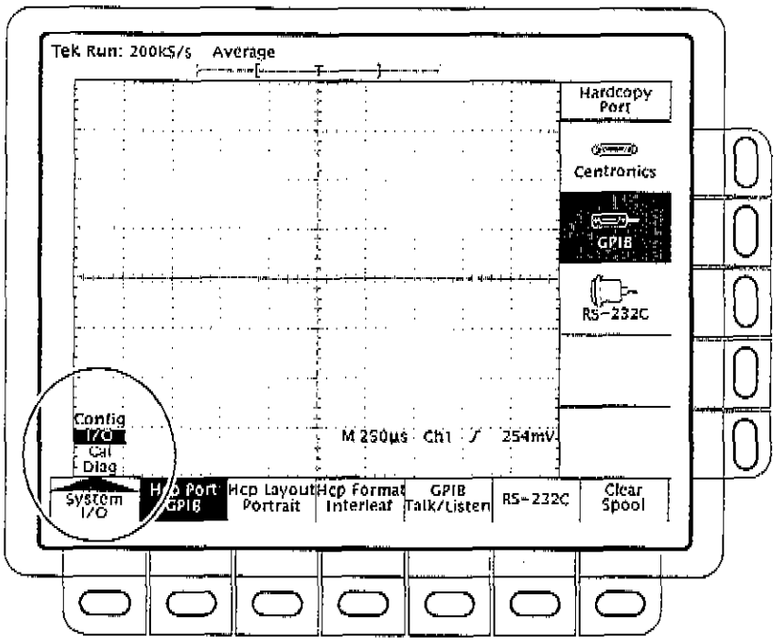

Figure 2–2: A pop-up menu

3. Push a side-menu button to select a subfunction.
4. Use the General Purpose Knob to alter variable-function or subfunction settings.
5. Press the CLEAR MENU button to remove a menu from the screen.

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Using the Probes

The TDS 340, TDS 360, and TDS 380 come with two standard-accessory probes. Use these probes to conduct signals to the oscilloscope. For detailed probe specifications and instructions, see the instruction manual packaged with the probe.

Connecting a Probe

To connect a probe to the oscilloscope, attach the BNC end of the probe to either the CH 1 or CH 2 input. Be sure to twist the probe end clockwise until the BNC is fully locked. See Figure 2–3.

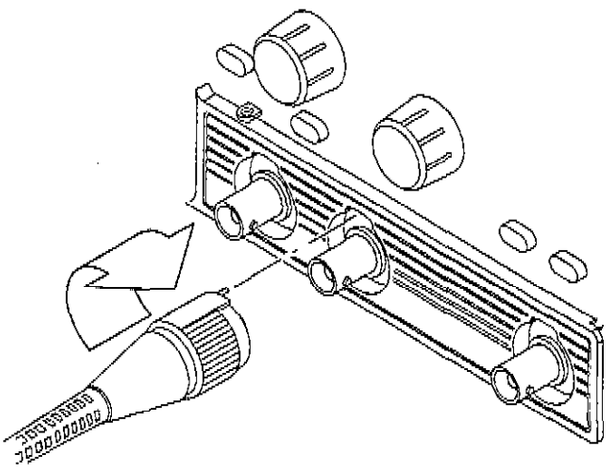

Figure 2–3: Connecting a probe

Compensating a Probe

Use the following procedure to compensate the probe every time you set up your oscilloscope.

1. Attach the probe BNC connector to the CH 1 input and attach the probe tip to the PROBE COMP output signal as shown in Figure 2–4. Attach the probe ground clip to the outer ring of the CH 2 BNC.

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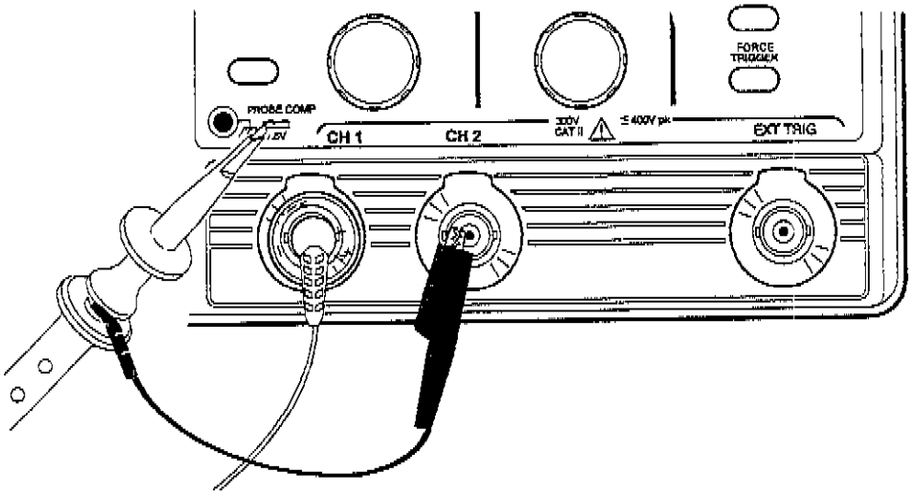

Figure 2–4: Probe compensation setup

2. Press AUTOSET. The oscilloscope displays the compensation waveform. It should resemble the waveform shown in Figure 2–5.

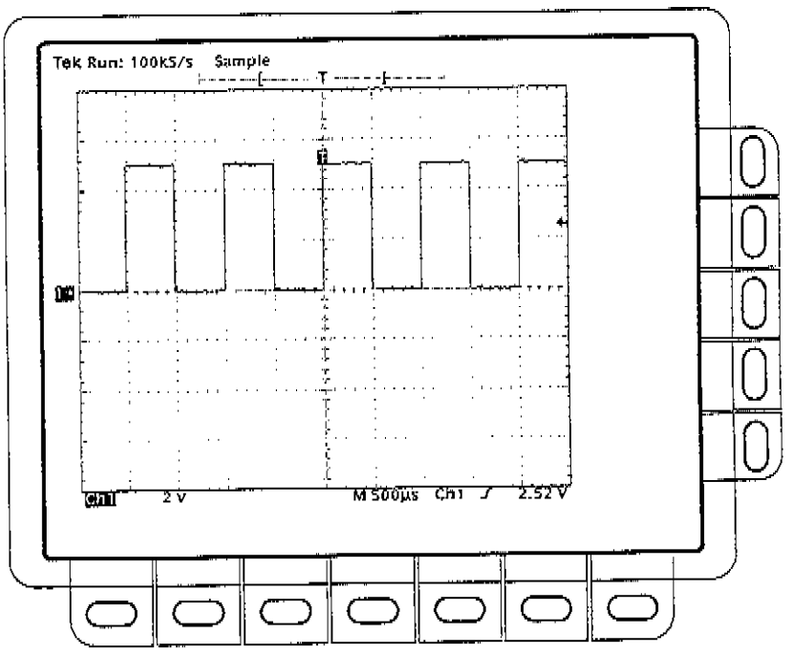

Figure 2–5: Compensation waveform

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3. Check that the waveform indicates correct compensation (see Figure 2–6). If the waveform indicates over or undercompensation, use the alignment tool provided with the probe to adjust the compensation as shown in Figure 2–7.

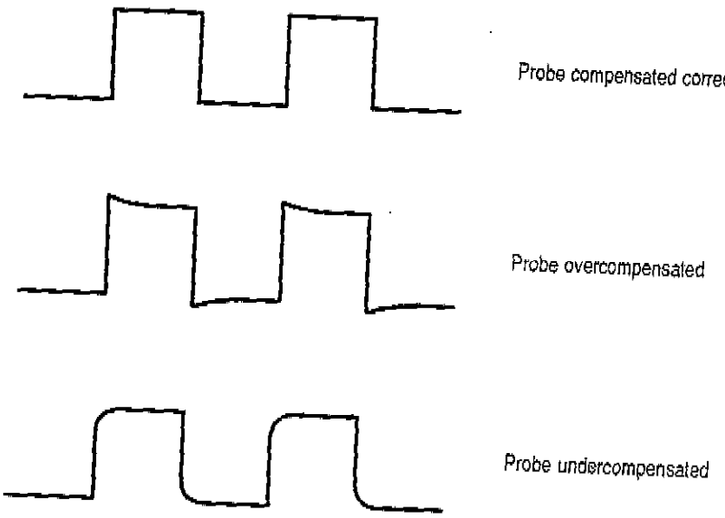

Figure 2–6: How probe compensation affects signals

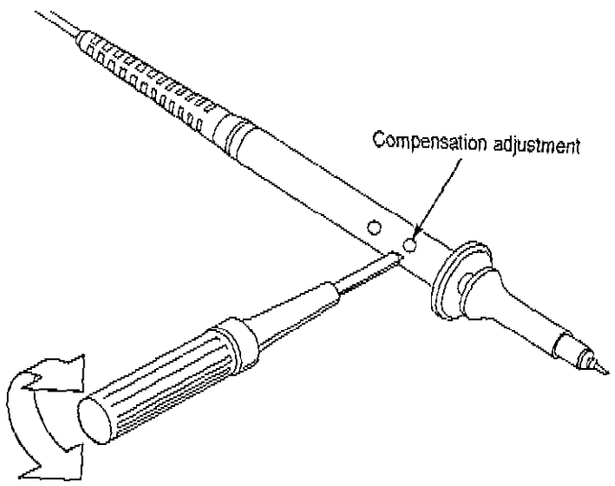

Figure 2–7: Location of probe compensation adjustment

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Using Autoset

The TDS 300 Series autoset feature produces a stable, triggered display of almost any input signal. To use autoset, connect a signal to either the CH 1 or CH 2 input connector, and press the AUTOSET button (shown in Figure 2–8).

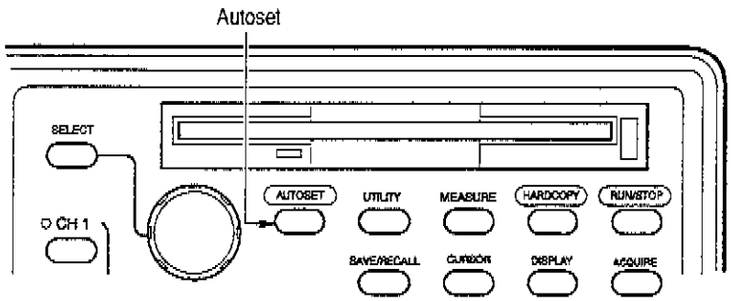

Figure 2–8: The AUTOSET button

Table 2–1 specifies the changes autoset makes in your oscilloscope setup.

Table 2–1: Autoset defaults

Control	Changed by autoset to
Selected channel	If none already displayed, numerically lowest of the displayed channels
Acquire Mode	Sample
Acquire Stop After	RUN/STOP button only
Display Style	Vectors
Display Intensity — Overall	If less than 50%, set to 75%
Display Format	YT
Horizontal Position	Centered within the graticule window
Horizontal Scale	As determined by the signal frequency
Horizontal Time Base	Main Only
Trigger Position	Unchanged
Trigger Type	Edge
Trigger Source	Numerically lowest of the displayed channels (the selected channel)
Trigger Level	Midpoint of data for the trigger source
Trigger Slope	Positive
Trigger Coupling	DC

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Table 2–1: Autoset defaults (Cont.)

Control	Changed by autoset to
Trigger Holdoff	500 ns
Vertical Scale	As determined by the signal level
Vertical Coupling	DC unless AC was previously set; AC remains unchanged
Vertical Bandwidth	Full
Vertical Offset	0 volts

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Appendix A: Specifications

This appendix contains complete specifications for the TDS 340, TDS 360, and TDS 380. The specifications are divided into three subsections, one for each of three classes of traits: *Warranted Characteristics, Typical Characteristics,* and *Nominal Traits.*

Warranted Characteristics

Warranted characteristics are described in terms of quantifiable performance limits that are warranted. This subsection lists only warranted characteristics.

NOTE. *In these tables, those warranted characteristics that are checked in the* Performance Tests, *starting on page B–5, appear in* ***boldface type*** *under the column* **Name**.

Performance Conditions

The electrical characteristics found in these tables of warranted characteristics apply when the oscilloscope has been adjusted at an ambient temperature between +20° C and +30° C, has had a warm-up period of at least 20 minutes, and is operating at an ambient temperature between –10° C and +55° C (unless otherwise noted).

Table A–1: Warranted characteristics — signal acquisition system

Name	Description	
Accuracy, DC Voltage Measurement, Average Acquisition Mode	**Measurement type**	**DC accuracy**
	Average of ≥16 waveforms	±(2.0% × |(reading – Net Offset[1])| + Offset Accuracy + 0.1 div)
	Delta volts between any two averages of ≥16 waveforms acquired under the same setup and ambient conditions	±(2.0% × |reading| + 0.15 div + 0.3 mV)
Accuracy, DC Gain, Sample or Average Acquisition Modes	±2%	
Pulse Response, Peak Detect and Envelope Mode	**Sec/Div setting**	**Minimum pulse width**
	5 s/div – 25 µs/div	10 ns
	TDS 340: 10 µs/div – 5 ns/div TDS 360: 10 µs/div – 2.5 ns/div TDS 380: 10 µs/div – 1 ns/div	The greater of 10 ns or .02 × sec/div setting

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Table A–1: Warranted characteristics — signal acquisition system (Cont.)

Name	Description	
Accuracy, Offset	**Volts/Div setting**	**Offset accuracy**
	2 mV/div – 99.5 mV/div	±(0.4% × |Net Offset[1]| + 3 mV + 0.1 div × V/div setting)
	100 mV/div – 995 mV/div	±(0.4% × |Net Offset[1]| + 30 mV + 0.1 div × V/div setting)
	1 V/div – 10 V/div	±(0.4% × |Net Offset[1]| + 300 mV + 0.1 div × V/div setting)
Analog Bandwidth, DC Coupled	TDS 340: DC – ≥100 MHz TDS 360: DC – ≥200 MHz; DC – ≥180 MHz for 2 mV/div TDS 380: DC – ≥400 MHz; DC – ≥250 MHz for 2 mV/div	
Cross Talk (Channel Isolation)	≥100:1 at 50 MHz with equal Volts/Div settings on each channel	
Input Impedance, DC-Coupled	TDS 340: 1 MΩ ±1% in parallel with 20 pF ±2.0 pF TDS 360: 1 MΩ ±1% in parallel with 20 pF ±2.0 pF TDS 380: 1 MΩ ±1% in parallel with 12 pF ±2.0 pF	
Input Voltage, Maximum	±300 V (DC or AC) CAT II; derate at 20 dB/decade above 100 kHz to 13 V peak AC at 3 MHz and above	
Lower Frequency Limit, AC Coupled[2]	≤10 Hz	

1 Net Offset = Offset – (Position × Volts/Div). Net offset is the voltage level at the center of the A-D converter dynamic range. Offset Accuracy is the accuracy of this voltage level.

2 The AC Coupled Lower Frequency Limits are reduced by a factor of 10 when 10X, passive probes are used.

Table A–2: Warranted characteristics — time base system

Name	Description
Accuracy, Long Term Sample Rate and Delay Time	±100 ppm over any ≥1 ms interval
Accuracy, Delta Time Measurements[1, 2]	For single-shot acquisitions using sample acquisition mode and a bandwidth limit setting of FULL: ±(1 WI + 100 ppm × |Reading| + 0.6 ns) For repetitive acquisitions using average acquisition mode with ≥16 averages and a bandwidth limit setting of FULL: ±(1 WI + 100 ppm × |Reading| + 0.4 ns)

1 For input signals ≥5 divisions in amplitude and a slew rate of ≥2.0 divisions/ns at the delta time measurement points. Signal must be acquired at a volts/division setting ≥5 mV/division.

2 The WI (waveform interval) is the time between the samples in the waveform record. Also, see the footnotes for *Sample Rate Range* and *Equivalent Time or Interpolated Waveform Rates* in Table A–11 on page A–8.

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Table A–3: Warranted characteristics — triggering system

Name	Description	
Accuracy, Trigger Level, DC Coupled	**Trigger source**	**Sensitivity**
	CH1 or CH2	±(3% of |Setting – Net Offset[1]| + 0.2 div × volts/div setting + Offset Accuracy)
	External	±(6% of |Setting| + 20 mV)
	External/10	±(6% of |Setting| + 200 mV)
Sensitivity, Edge-Type Trigger, DC Coupled	**Trigger source**	**Sensitivity**
	CH1 or CH2	TDS 340: 0.35 division from DC to 20 MHz, increasing to 1 div at 100 MHz TDS 360: 0.35 division from DC to 50 MHz, increasing to 1 div at 200 MHz TDS 380: 0.35 division from DC to 50 MHz, increasing to 1 div at 400 MHz
	External	TDS 340: 50 mV from DC to 20 MHz, increasing to 150 mV at 100 MHz TDS 360: 50 mV from DC to 50 MHz, increasing to 150 mV at 200 MHz TDS 380: 50 mV from DC to 50 MHz, increasing to 500 mV at 400 MHz
	External/10	TDS 340: 500 mV from DC to 20 MHz, increasing to 1.5 V at 100 MHz TDS 360: 500 mV from DC to 50 MHz, increasing to 1.5 V at 200 MHz TDS 380: 500 mV from DC to 50 MHz, increasing to 5.0 V at 400 MHz
Input Impedance, External Trigger	1 MΩ ±2% in parallel with 20 pF ±2 pF	
Maximum Input Voltage, External Trigger	±300 V (DC or AC) CAT II; derate at 20 dB/decade above 100 kHz to 13 V peak AC at 3 MHz and above	

1 **Net Offset = Offset – (Position × Volts/Div). Net Offset is the voltage level at the center of the A-D converter dynamic range. Offset Accuracy is the accuracy of this voltage level.**

Table A–4: Power Requirements

Name	Description
Source Voltage and Frequency	90 to 132 VAC_{RMS}, continuous range, for 47 Hz through 440 Hz 132 to 250 VAC_{RMS}, continuous range, for 47 Hz through 63 Hz
Power Consumption	≤65 Watts (120 VA)

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Table A–5: Warranted characteristics — environmental

Name	Description
Atmospherics (TDS 340)	Temperature: −10° C to +55° C, operating; −51° C to +71° C, non-operating Relative humidity: to 95%, at or below +40° C, or to 75% from +41° C to +55° C Altitude: To 15,000 ft (4570 m), operating; to 40,000 ft (12190 m), non-operating
Atmospherics (TDS 360 or TDS 380)	Temperature without diskette in floppy disk drive: +4° C to +50° C, operating; −22° C to +60° C, non-operating Temperature with diskette in floppy disk drive: +10° C to +50° C, operating or non-operating Relative humidity without diskette in floppy disk drive: to 80% at or below +29° C, or to 20% from +30° C to +50° C, operating; to 90% at or below +40° C, or to 5% from +41° C to +50° C, non-operating; Relative humidity with diskette in floppy disk drive: to 80% at or below +29° C, or to 20% from +30° C to +50° C, operating or non-operating Altitude: To 15,000 ft (4570 m), operating; to 40,000 ft (12190 m), non-operating
Dynamics	Random vibration without diskette in floppy disk drive: 0.31 g_{RMS}, from 5 to 500 Hz, 10 minutes each axis, operating; 2.46 g_{RMS}, from 5 to 500 Hz, 10 minutes each axis, non-operating

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Typical Characteristics

Typical characteristics are described in terms of typical or average performance. Typical characteristics are not warranted.

Table A–6: Typical characteristics — signal acquisition system

Name	Description			
Accuracy, DC Gain, Envelope Acquisition Mode	±3% for sec/div settings from 5 Sec/Div to 25 µsec/div; ±2% for sec/div settings from 10 µs/div to 5 ns/div (TDS 340); ±2% for sec/div settings from 10 µs/div to 2.5 ns/div (TDS 360); ±2% for sec/div settings from 10 µs/div to 1 ns/div (TDS 380)			
Accuracy, DC Voltage Measurement, Sample Acquisition Mode	**Measurement type**		**DC accuracy**	
	Any Sample		±(2.0% × (reading – Net Offset[1]) + Offset Accuracy + 0.13 div + 0.6 mV)	
	Delta Volts between any two samples[2] acquired under the same setup and ambient conditions		±(2.0% × reading + 0.26 div + 1.2 mV)	
Frequency Limit, Upper, 20 MHz Bandwidth Limited	20 MHz			
Step Response Settling Error	**Volts/Div setting**	**Step amplitude**	**Settling error (%)[3]**	
			100 ns	**20 ms**
	2 mV/div – 99.5 mV/div	≤2 V	≤1.0	≤0.1
	100 mV/div – 995 mV/div	≤20 V	≤1.5	≤0.2
	1 V/div – 10 V/div	≤200 V	≤2.5	≤0.2
Common Mode Rejection Ratio (CMRR)	100:1 at 60 Hz, reducing to 20:1 at 50 MHz, with equal Volts/Div and Coupling settings on each channel.			

1 **Net Offset = Offset – (Position × Volts/Div). Net Offset is the voltage level at the center of the A-D converter dynamic range. Offset Accuracy is the accuracy of this voltage level.**

2 **The samples must be acquired under the same setup and ambient conditions.**

3 **The values given are the maximum absolute difference between the value at the end of a specified time interval after the mid-level crossing of the step, and the value one second after the mid-level crossing of the step, expressed as a percentage of the step amplitude.**

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Table A–7: Typical characteristics — triggering system

Name	Description	
Error, Trigger Position, Edge Triggering	**Acquire mode**	**Trigger-position error[1,2]**
	Sample, Average	±(1 WI + 2 ns)
	Peak Detect, Envelope	±(2 WI + 2 ns)
Sensitivity, Video-Type Trigger	**Source**	**Typical sensitivity**
	CH1 or CH2 External External/10	0.6 division of video sync signal 75 mV of video sync signal 750 mV of video sync signal
Lowest Frequency for Successful Operation of "Set Level to 50%" Function	50 Hz	
Sensitivity, Edge Type Trigger, Not DC Coupled[3]	**Trigger coupling**	**Typical signal level for stable triggering**
	AC	Same as DC-coupled limits[4] for frequencies above 60 Hz. Attenuates signals below 60 Hz.
	Noise Reject	Three and one half times the DC-coupled limits.[4]
	High Frequency Reject	One and one half times times the DC-coupled limits[4] from DC to 30 kHz. Attenuates signals above 30 kHz.
	Low Frequency Reject	One and one half times the DC-coupled limits[4] for frequencies above 80 kHz. Attenuates signals below 80 kHz.

1 The trigger position errors are typically less than the values given here. These values are for triggering signals having a slew rate at the trigger point of ±0.5 division/ns.

2 The waveform interval (WI) is the time between the samples in the waveform record. Also, see the footnote for the characteristics *Sample Rate Range* and *Equivalent Time or Interpolated Waveform Rates* in Table A–11 on page A–8.

3 The minimum sensitivity for obtaining a stable trigger. A stable trigger results in a uniform, regular display triggered on the selected slope. The trigger point must not switch between opposite slopes on the waveform, and the display must not "roll" across the screen on successive acquisitions. The TRIG'D LED stays constantly lighted when the SEC/DIV setting is 2 ms or faster but may flash when the SEC/DIV setting is 10 ms or slower.

4 See the characteristic *Sensitivity, Edge-Type Trigger, DC Coupled* in Table A–3, which begins on page A–3.

Table A–8: Typical characteristics — probe compensator output

Name	Description	
Output Voltage and Frequency, Probe Compensator	**Characteristic**	
	Voltage	5.0 V (low-high) into a 1 MΩ load
	Frequency	1 kHz

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Table A–9: Typical characteristics — data handling

Name	Description
Time, Data-Retention, Nonvolatile Memory[1,2]	≥5 Years

1. The time that reference waveforms, stored setups, and calibration constants are retained when there is no power to the oscilloscope.
2. Data is maintained by a lithium poly-carbon monofluoride battery.

Nominal Traits

Nominal traits are described using simple statements of fact such as "Two, identical" for the trait "Input Channels, Number of," rather than in terms of limits that are performance requirements.

Table A–10: Nominal traits — signal acquisition system

Name	Description	
Bandwidth Selections	20 MHz and FULL	
Digitizers, Number of	Two, identical, digitized simultaneously	
Digitized Bits, Number of	8 bits[1]	
Input Channels, Number of	Two, identical, called CH 1 and CH 2	
Input Coupling	DC, AC, or GND	
Ranges, Offset, All Channels	**Volts/Div setting**	**Offset range**
	2 mV/div – 99.5 mV/div	±1 V
	100 mV/div – 995 mV/div	±10 V
	1 V/div – 10 V/div	±100 V
Range, Position	±5 divisions	
Range, Sensitivity[2]	2 mV/div to 10 V/div	
Rise Time	TDS 340: 3.5 ns TDS 360: 1.75 ns TDS 380: 875 ps	
TekProbe Interface	Level one probe coding	

1. Displayed vertically with 25 digitization levels (DLs) per division and 10.24 divisions dynamic range with zoom off. A DL is the smallest voltage level change that the 8-bit A-D Converter can resolve, with the input scaled to the volts/division setting of the channel used. Expressed as a voltage, a DL is equal to 1/25 of a division times the volts/division setting.
2. The sensitivity ranges from 2 mV/div to 10 V/div in a 1–2–5 sequence of coarse settings. Between consecutive coarse settings, the sensitivity can be finely adjusted with a resolution of 1% of the more sensitive setting. For example, between 50 mV/div and 100 mV/div, the volts/division can be set with 0.5 mV resolution.

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Table A–11: Nominal traits — time base system

Name	Description
Range, Sample-Rate[1,2]	TDS 340: 10 Samples/s to 500 MSamples/s in a 1–2–5 sequence TDS 360: 10 Samples/s to 1 GSamples/s in a 1–2–5 sequence TDS 380: 10 Samples/s to 2 GSamples/s in a 1–2–5 sequence
Range, Seconds/Division	TDS 340: 5 ns/div to 5 s/div in a 1–2.5–5 sequence TDS 360: 2.5 ns/div to 5 s/div in a 1–2.5–5 sequence TDS 380: 1 ns/div to 5 s/div in a 1–2.5–5 sequence
Range, Time Base Delay Time	16.5 ns to 50 seconds
Record Length	1,000 samples

1 The range of real-time rates, expressed in samples/second, at which a digitizer samples signals at its inputs and stores the samples in memory to produce a record of time-sequential samples

2 The Waveform Rate (WR) is the equivalent sample rate of a waveform record. For a waveform record acquired by real-time sampling of a single acquisition, the waveform rate is the same as the real-time sample rate; for a waveform created by interpolation of real-time samples from a single acquisition or by equivalent-time sampling of multiple acquisitions, the waveform rate is faster than the real time sample rate. For all three cases, the waveform rate is 1/(Waveform Interval) for the waveform record, where the waveform interval (WI) is the time between the samples in the waveform record.

Table A–12: Nominal traits — triggering system

Name	Description	
Range, Hold Off	500 ns minimum to 10 seconds maximum	
Ranges, Trigger Level	**Source**	**Range**
	Any Channel	±12 divisions from center of screen
	External	±1.5 Volts
	External /10	±15 Volts
	Line	±300 Volts
Formats and Field Rates, Video Trigger	Triggers from sync-negative composite video, 525 to 625 lines, 50 Hz to 60 Hz, interlaced or noninterlaced systems with scan rates from 15 kHz to 65 kHz – such as NTSC, PAL, or SECAM	
TekProbe Interface, External Trigger	Level one probe coding	

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Table A–13: Nominal traits — display system

Name	Description
CRT Type	7-inch (17.95 cm) diagonal, magnetic deflection; horizontal raster-scan; P31 green phosphor
Video Display Resolution	640 pixels horizontally by 480 pixels vertically Display area is 5.04 inch (12.92 cm) horizontally by 3.78 inch (9.69 cm) vertically
Waveform Display Graticule	A single graticule 401 × 501 pixels (8 × 10 divisions, with divisions that are approximately 1 cm by 1 cm)
Intensity Levels	Dim and Bright, with adjustable Overall Intensity and Contrast

Table A–14: Nominal traits — I/O interface option

Name	Description
GPIB	Part of Option 14 I/O interface or TD3F14A I/O interface field upgrade kit; complies with IEEE Std 488–1987
RS-232	Part of Option 14 I/O interface or TD3F14A I/O interface field upgrade kit; a 9-pin male DTE RS-232 interface that complies with EIA/TIA 574–90
Centronics	Part of Option 14 I/O interface or TD3F14A I/O interface field upgrade kit; a 25-pin, IBM PC-type, parallel printer interface that complies electrically with Centronics C332–44, Rev A
Video Signal Output (Option 14 Only)	DB-9 rear panel Video connector; non-interlaced, with levels that comply with ANSI RS343A VGA compatible at a 30.6 kHz sync rate
Power Supply, Printer (Option 14 Only)	Power supply connector to supply power to the Option 3P Printer Pack

Table A–15: Nominal traits — power distribution system

Name	Description
Fuse Rating	5 mm × 20 mm, 3.15 A (T), 250 V; or 1.25 in × 0.25 in, 3 A (T), 250 V

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Table A–16: Nominal traits — mechanical characteristics

Name	Description
Weight	
Standard TDS 340	6.8 kg (15 lbs) stand-alone instrument; 8.4 kg (18.5 lbs) with front cover, accessories, and accessories pouch installed; 12.7 kg (28 lbs) when packaged for domestic shipment
Standard TDS 360 or TDS 380	7.0 kg (15.5 lbs) stand-alone instrument; 8.6 kg (19 lbs) with front cover, accessories, and accessories pouch installed; 12.9 kg (28.5 lbs) when packaged for domestic shipment
Rackmount TDS 340	6.4 kg (14 lbs), plus weight of rackmount parts, for TDS 340 (Option 1R); 14.5 kg (32 lbs) when the rackmounted TDS 340 is packaged for domestic shipment
Rackmount TDS 360 or TDS 380	6.6 kg (14.5 lbs), plus weight of rackmount parts, for TDS 360 or TDS 380 (Option 1R); 14.7 kg (32.5 lbs) when the rackmounted TDS 360 or TDS 380 is packaged for domestic shipment
Rackmount conversion kit	4.5 kg (10 lbs); 7.5 kg (17.5 lbs) when kit is packaged for domestic shipment
Overall Dimensions	
Standard Instrument (Figure A–1)	Height: 191 mm (7.5 in) with feet and accessories pouch installed 165 mm (6.5 in) without the accessories pouch installed Width: 362 mm (14.25 in) with handle Depth: 471 mm (18.55 in) stand-alone instrument 490 mm (19.28 in) with front cover installed 564 mm (22.2 in) with handle extended
Rackmount Instrument	Height: 178 mm (7 in) Width: 483 mm (19 in) Depth: 472 mm (18.6 in) without handles; 517 mm (20.35 in) including handles

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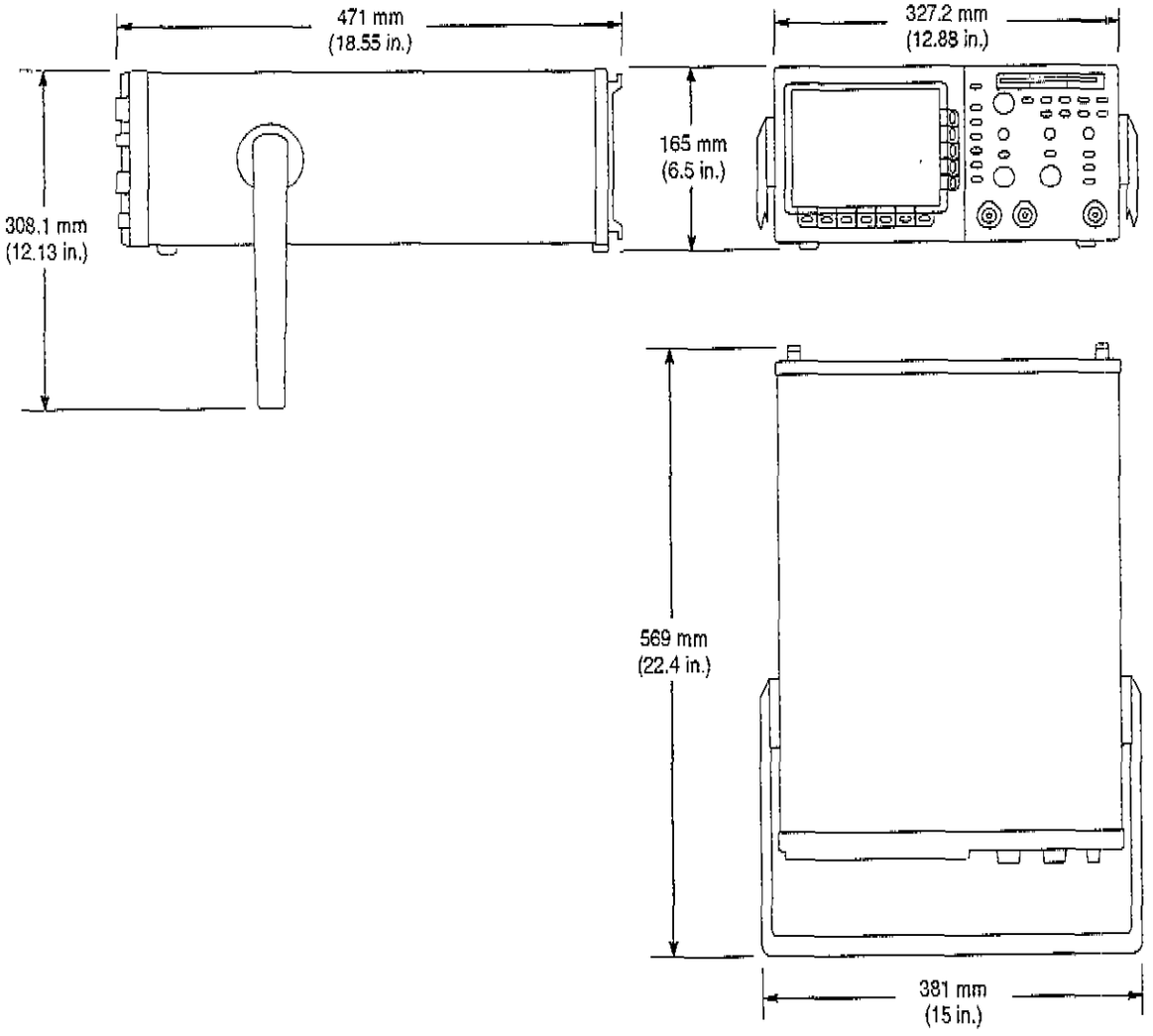

Figure A–1: TDS 340, TDS 360, and TDS 380 dimensions

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Table A–17: Certifications and compliances

EC Declaration of Conformity	Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility and Low Voltage Directive 73/23/ECC for Product Safety. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities: EMC Directive 89/336/EEC: EN 55011 — Class B Radiated and Conducted Emissions [1] EN 50081-1 Emissions: EN 60555-2 — AC Power Line Harmonic Emissions EN 50082-1 Immunity: IEC 801-2 — Electrostatic Discharge Immunity IEC 801-3 — RF Electromagnetic Field Immunity [2] IEC 801-4 — Electrical Fast Transient/Burst Immunity IEC 801-5 — Power Line Surge Immunity Low Voltage Directive 73/23/EEC: EN 61010-1 — Safety requirements for electrical equipment for measurement, control, and laboratory use 1 To maintain emission requirements when connecting to the I/O interface of this oscilloscope, use only a high-quality, double-shielded (braid and foil) cable. The cable shield must have low-impedance connections to both connector housings. The VGA cable must also have a ferrite core at both ends. Acceptable cables are listed in Table C–6 on page C–4. 2 Performance criteria: ≤±0.3 division waveform displacement, or ≤0.6 division increase in p-p noise from 27 MHz to 500 MHz. Test conditions: both channel inputs terminated with grounding caps, both channels set to 10 mV/div, both channels set to DC Coupling, trigger source set to CH 1, acquisition mode set to Sample, and time base set to 250 µs/div.
Certifications	Underwriters Laboratories listing to Standard UL3111–1 for Electrical Measuring and Test Equipment. [3,4] Canadian Standards Association certified to Standard CAN/CSA-C22.2 No. 1010.1–92. [3] 3 These standards are North American interpretations of IEC 1010. 4 Conditions for certification: operating temperature –10° C to +55° C, maximum operating altitude 2000 m, Safety Class I (IEC 1010-1 Annex H), Overvoltage Catagory II (IEC 1010-1 Annex J), Pollution Degree 2 (IEC 1010-1).
FCC Compliance	Emissions comply with FCC Code of Federal Regulations 47, Part 15, Subpart B, Class A Limits
CSA Certified Power Cords	CSA Certification includes the products and power cords appropriate for use in the North America power network. All other power cords supplied are approved for the country of use.
Overvoltage Category	Category: — Examples of Products in this Category: CAT III — Distribution-level mains, fixed installation CAT II — Local-level mains, appliances, portable equipment CAT I — Signal levels in special equipment or parts of equipment, telecommunications, electronics
Pollution Degree 2	Do not operate in environments where conductive pollutants may be present.

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Appendix B: Performance Verification

The procedure in this appendix verifies that the TDS 340, TDS 360, and TDS 380 oscilloscopes meet warranted specifications. Depending on what you want to accomplish, you may prefer to perform another procedure you can find elsewhere in this manual.

- To rapidly confirm that this oscilloscope functions, just do the procedures under *Self Tests*, which begin on page 1–5.

  Advantages: This procedure is quick to do, requires no external equipment or signal sources, and performs extensive functional and accuracy testing to provide high confidence that the oscilloscope performs properly. You can use it as a quick check before making a series of important measurements.

- To further check functionality, do the procedures under *Functional Tests* that begin on page 1–7.

  Advantages: These procedures require minimal additional time to perform, require no additional equipment other than a standard-accessory probe, and more completely test the internal hardware of this oscilloscope. You can use them to quickly determine if the oscilloscope is suitable for putting into service, such as when it is first received.

- If you need a more extensive confirmation of performance, do the *Performance Tests* in this appendix, beginning on page B–5, after doing the *Functional* and *Self Tests* just referenced.

  Advantages: These procedures add direct checking of warranted specifications. They require more time and suitable test equipment. (See *Equipment Required* on page B–3.)

Conventions

Throughout these procedures the following conventions apply:

- Each test procedure uses the following general format:

  Title of Test
  Equipment Required
  Time Required
  Prerequisites
  Procedure

- Refer to Figure B–1: "Main menu" refers to the menu that labels the seven menu buttons under the display. "Side menu" refers to the menu that labels

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the five buttons to the right of the display. "Pop-up menu" refers to a menu that pops up when a main menu button is pressed.

- Where instructed to use a front-panel button or knob, select from a main or side menu, or verify a readout or status message, the name of the button or knob appears in boldface type.
- Instructions for menu selection follow this format: **FRONT PANEL BUTTON → Pop-Up (if necessary) → Main Menu Button → Side Menu Button**. For example, "Push **TRIGGER MENU → Type: Video → Trigger On → Lines.**"

STOP *This symbol denotes information you must read to do the procedure properly.*

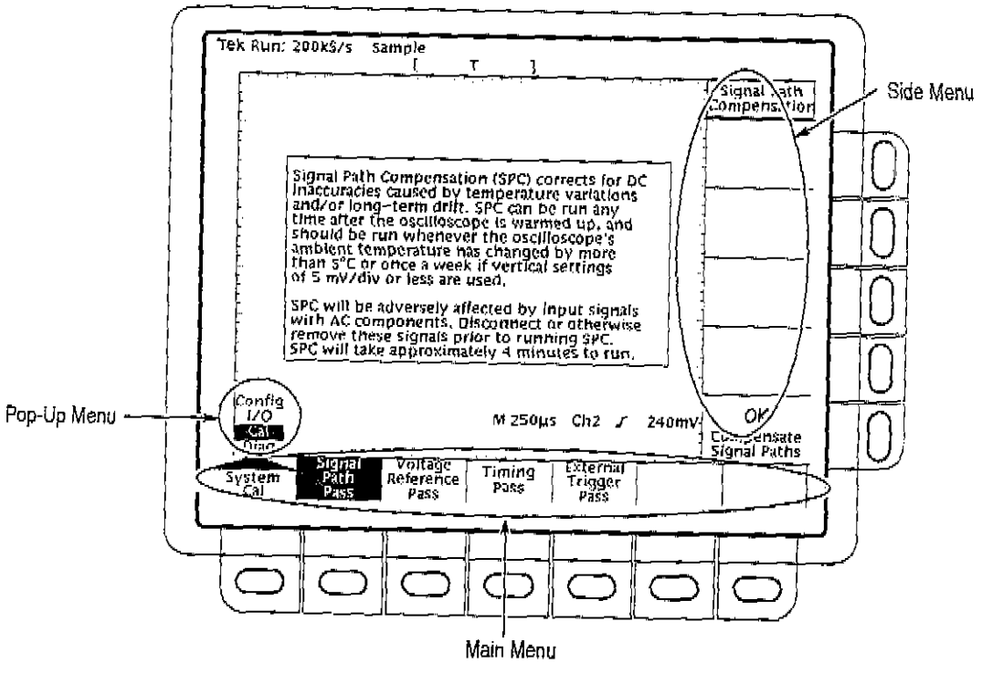
Tek Run: 200kS/s Sample
Signal Path Compensation (SPC) corrects for DC inaccuracies caused by temperature variations and/or long-term drift. SPC can be run any time after the oscilloscope is warmed up, and should be run whenever the oscilloscope's ambient temperature has changed by more than 5°C or once a week if vertical settings of 5 mV/div or less are used.
SPC will be adversely affected by input signals with AC components. Disconnect or otherwise remove these signals prior to running SPC. SPC will take approximately 4 minutes to run.
Side Menu
Pop-Up Menu
Config I/O
Cal
M 250µs Ch2 ƒ 240mV
OK
Compensate Signal Paths
System Cal
Signal Path Pass
Voltage Reference Pass
Timing Pass
External Trigger Pass
Main Menu

Figure B–1: Menu locations

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Test Equipment

These procedures use external, traceable signal sources to directly check instrument performance. If your test equipment does not meet the minimum requirements listed in Table B–1, your test results will be invalid.

Table B–1: Test equipment

Item number and description	Minimum requirements	Example	Purpose
1. Termination 50 Ω (two required)	Impedance 50 Ω; connectors: female BNC input, male BNC output	Tektronix part number 011-0049-01	Checking delay between channels
2. Cable, Precision Coaxial (two required)	50 Ω, 91 cm (36 in), male to male BNC connectors	Tektronix part number 012-0482-00	Signal interconnection
3. Connector, Dual-Banana	Female-BNC to dual-banana	Tektronix part number 103-0090-00	Several accuracy tests
4. Connector, BNC "T"	Male-BNC to dual-female-BNC	Tektronix part number 103-0030-00	Checking trigger sensitivity
5. Coupler, Dual-Input	Female-BNC to dual-male-BNC	Tektronix part number 067-0525-02	Checking delay between channels
6. Generator, DC Calibration	Variable amplitude to ±110 V; accuracy to 0.1%	Wavetek 9100 Calibration System with Option 250	Checking DC offset, gain, and measurement accuracy
7. Generator, Leveled Sine Wave, Medium-Frequency	200 kHz to 250 MHz; variable amplitude from 5 mV to 4 V_{p-p} into 50 Ω	Wavetek 9100 Calibration System with Option 250	Checking bandwidth and trigger sensitivity
8. Generator, Leveled Sine Wave, High-Frequency[1]	200 kHz to 400 MHz; variable amplitude from 5 mV to 4 V_{p-p} into 50 Ω	Rohde & Schwarz SMY with URV 35 Power Meter and NRV–Z8 Power Sensor	Checking bandwidth and trigger sensitivity
9. Generator, Time Mark	Variable marker frequency from 10 ms to 10 ns; accuracy within 2 ppm	Wavetek 9100 Calibration System with Option 250	Checking sample rate and delay-time accuracy
10. Probe, 10X, included with this instrument	A P6109B (TDS 340), P6111B (TDS 360), or P6114B (TDS 380) probe	Tektronix number P6109B (TDS 340), P6111B (TDS 360), or P6114B (TDS 380)	Signal interconnection

[1] **The high frequency leveled sine wave generator is only required to verify the TDS 380, not the TDS 340 or TDS 360. If you use the example equipment, refer to *Sine Wave Generator Leveling Procedure* on page B–14 for information on obtaining a leveled output from an unleveled sine wave generator. If available, you can use a Tektronix SG504 Leveled Sine Wave Generator in place of the example equipment.**

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Test Record

Photocopy this page and use it to record the performance test results for your instrument.

TDS 340, TDS 360, and TDS 380 test record

Instrument Serial Number: _____ Certificate Number: _____
Temperature: _____ RH %: _____
Date of Calibration: _____ Technician: _____

Performance test		Minimum	Incoming	Outgoing	Maximum
DC Voltage Measurement Accuracy					
CH1 VOLTS/DIV 1 V		+97.1 V	_____	_____	+98.9 V
	200 mV	+8.28 V	_____	_____	+8.52 V
	50 mV[1]	–581 mV	_____	_____	–619 mV
	50 mV[2]	–881 mV	_____	_____	–919 mV
	Δ at 50 mV	+286 mV	_____	_____	+314 mV
	10 mV	+54.6 mV	_____	_____	+65.4 mV
	5 mV	–982 mV	_____	_____	–998 mV
CH2 VOLTS/DIV 1 V		+97.1 V	_____	_____	+98.9 V
	200 mV	+8.28 V	_____	_____	+8.52 V
	50 mV[1]	–581 mV	_____	_____	–619 mV
	50 mV[2]	–881 mV	_____	_____	–919 mV
	Δ at 50 mV	+286 mV	_____	_____	+314 mV
	10 mV	+54.6 mV	_____	_____	+65.4 mV
	5 mV	–982 mV	_____	_____	–998 mV
Analog bandwidth					
CH1		42.5 mV	_____	_____	N/A
CH2		42.5 mV	_____	_____	N/A
Long term sample rate and delay time accuracy					
		–2.0 Div	_____	_____	+2.0 Div
Edge trigger sensitivity, DC coupled					
Main Trigger		stable trigger	_____	_____	N/A
Main Trigger – Falling		stable trigger	_____	_____	N/A

1 **Generator set at –0.6 V.**
2 **Generator set at –0.9 V.**

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Performance Test Overview

The procedures are in three groupings: *Signal Acquisition System Checks*, *Time Base System Checks*, and *Triggering System Checks*. They check all the characteristics that appear in **boldface** type under *Warranted Characteristics* on page A–1.

Prerequisites

The tests in this subsection comprise an extensive, valid confirmation of performance and functionality when the following requirements are met:

- The cabinet must be installed.
- You must have performed and passed the procedures under *Self Tests*, on page 1–5 and those under *Functional Tests*, on page 1–7.
- The digitizing oscilloscope must have been operating for a warm-up period of at least 20 minutes, and must be operating at an ambient temperature between –10° C and +55° C.

Signal Acquisition System Checks

These procedures check signal acquisition system characteristics that are listed as checked under *Warranted Characteristics* in the *Specifications* section.

Check DC Voltage Measurement Accuracy

WARNING. *Performance of this procedure requires input voltages up to 98 VDC. Contact with live circuits could cause injury or death. Be sure to set the DC calibration generator to 0 volts before connecting, disconnecting, and/or moving the test hookup during the performance of this procedure.*

Equipment Required: One dual-banana connector (Item 3), one DC calibration generator (Item 6), and one precision coaxial cable (Item 2).

Time Required: Approximately 35 minutes.

Prerequisites: The oscilloscope must meet the prerequisites listed on page B–5.

Procedure:

1. Set the output of a DC calibration generator to 0 volts.

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2. Connect the output of a DC calibration generator through a dual-banana connector followed by a 50 Ω precision coaxial cable to **CH 1**, as shown in Figure B–2.

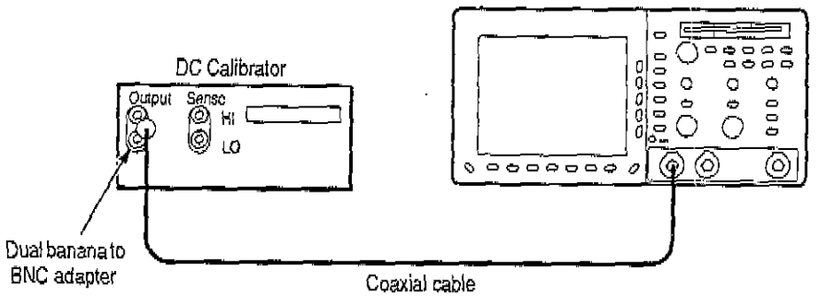

Figure B–2: Hookup for DC voltage measurement accuracy check

3. Press **SAVE/RECALL SETUP → Recall Factory Setup → OK Confirm Factory Init.**
4. Press **ACQUIRE → Mode → Average 16.**
5. Press **MEASURE → Select Measurement.**
6. Press the side menu button **more** until the menu label **Mean** appears in the side menu. Press the side menu button **Mean.**
7. Set the vertical **SCALE** to one of the settings listed in Table B–2 that you have not yet checked. (Start with the first setting listed.)
8. Press **VERTICAL MENU → Position.**
9. Turn the **General Purpose Knob** to set the vertical position to the setting listed in Table B–2. The baseline level moves off screen.
10. Press the main menu button **Offset.**
11. Use the **General Purpose Knob** to set vertical offset to the setting listed in Table B–2 for the present vertical scale setting. The baseline level remains off screen.

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Table B–2: DC accuracy

Vertical scale setting	Position setting (divs)	Offset setting	Generator setting	Accuracy limits
1 V	+5	+100 V	+98 V	+97.1 V to +98.9 V
200 mV	+5	+10 V	+8.4 V	+8.28 V to +8.52 V
50 mV	–5	–1 V	–0.6 V	–581 mV to –619 mV
50 mV	–5	–1 V	–0.9 V	–881 mV to –919 mV
Δ at 50 mV				+286 mV to +314 mV
10 mV	–5	0 V	+60 mV	+54.6 mV to +65.4 mV
5 mV	0	–1 V	–990 mV	–982 mV to –998 mV

12. Set the generator to the level and polarity indicated in Table B–2 for the vertical scale, position, and offset settings you have made. The DC test level should appear on screen. (If it does not return, the DC accuracy check has failed for the present vertical scale setting of the current channel.)

13. Check that the readout for the measurement **Mean** readout on screen is within the limits listed for the present vertical scale and position/offset/generator settings.

14. Repeat steps 7 through 13 until you have checked all the vertical scale settings listed in Table B–2. Record the measurements for each of the 50 mV settings.

15. Subtract the second 50 mV measurement from the first and compare the result to the "Δ at 50 mV" limits in Table B–2.

16. Press **WAVEFORM OFF**; then, press **CH 2**.

17. Set the generator output to 0 V.

18. Move the test hookup to the **CH 2** input.

19. Repeat steps 5 through 15 for channel 2.

20. Set the generator output to 0 V.

21. Disconnect the cable at the **CH 2** input connector.

DC Gain Accuracy

DC gain accuracy is verified by successful completion of the self tests and the DC voltage measurement accuracy (in the previous procedure).

Offset Accuracy

Offset accuracy is verified by successful completion of the Self Tests and the DC voltage measurement accuracy (in the previous procedure).

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Check Analog Bandwidth

Equipment Required: One leveled sine wave generator (Item 7 or 8), one 50 Ω precision cable (Item 2), and one 50 Ω termination (Item 1).

Time Required: Approximately 20 minutes.

Prerequisites: See page B–5.

Procedure:

1. Connect, through a 50 Ω precision cable and a 50 Ω termination, the sine wave output of a leveled sine wave generator to **CH 1** (see Figure B–3). Set the output of the generator to a reference frequency of 50 kHz.

NOTE. *If you are verifying a TDS 380, you need a leveled sine wave generator with a 400 MHz output frequency. Refer to* Sine Wave Generator Leveling Procedure *on page B–14 for information on obtaining a leveled output from an unleveled sine wave generator.*

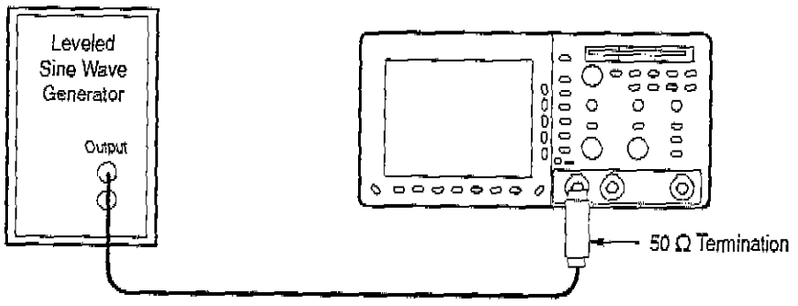

Figure B–3: Hookup for analog bandwidth check

1. Press **SAVE/RECALL SETUP → Recall Factory Setup → OK Confirm Factory Init.**
2. Set the horizontal **SCALE** to 10 µs/div.
3. Press **TRIGGER MENU → Coupling → Noise Rej.**
4. Press **ACQUIRE → Mode → Average 16.**
5. Press **MEASURE → High–Low Setup → Min–Max.**
6. Press the main menu button **Select Measurement.** Now press the side menu button **more** until the menu label **Pk-Pk** appears in the side menu. Press the side menu button **Pk-Pk.**
7. Set the vertical **SCALE** to 10 mV/div.

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8. Set the generator output so the **CHx Pk-Pk** readout equals 60 mV.
9. Press **SET LEVEL TO 50%** as necessary to trigger the display.
10. Increase the frequency of the generator output to 100 MHz (TDS 340), 200 MHz (TDS 360), or 400 MHz (TDS 380).
11. Set the horizontal **SCALE** to 5 ns/div (TDS 340), 2.5 ns/div (TDS 360), or 2.5 ns/div (TDS 380).
12. Press **SET LEVEL TO 50%** as necessary to trigger the display.
13. Check that the **Pk-Pk** readout on screen (as shown in Figure B–4) is ≥42.5 mV.

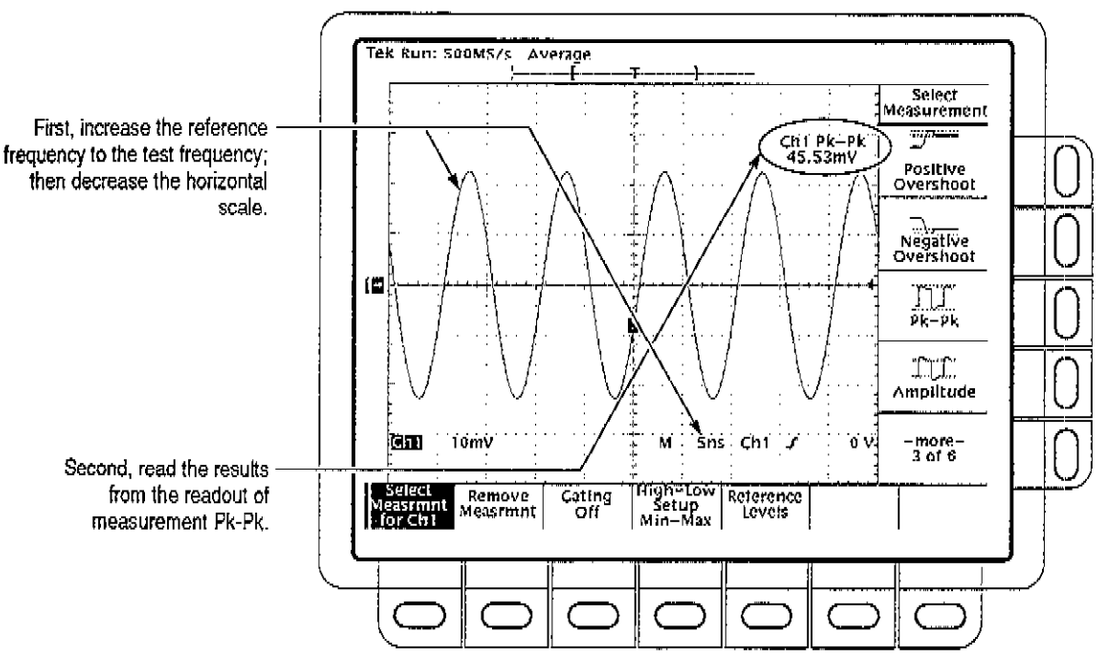

Figure B–4: Measuring analog bandwidth

14. When finished checking, set the horizontal **SCALE** back to the 10 µs/div setting, and set the generator output frequency back to 50 kHz.
15. Press **WAVEFORM OFF** to remove Channel 1 from the display.
16. Press **CH 2** and move the hookup to the **CH 2** input.
17. Press **TRIGGER MENU** → **Source** → **CH 2**.
18. Repeat steps 6 through 13 for **CH 2**.

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19. Disconnect the test hook up from the **CH 2** input connector.

Time Base System Checks

This procedure checks those characteristics that relate to the Main and Delayed time base system and are listed as checked under *Warranted Characteristics* in the *Specifications* section.

Check Long-Term Sample Rate and Delay Time Accuracy

Equipment Required: One time-marker generator (Item 9), one precision coaxial cable, (Item 2) and one 50 Ω termination (Item 1).

Time Required: Approximately 5 minutes.

Prerequisites: See page B–5.

Procedure:

1. Connect, through a 50 Ω precision coaxial cable and a 50 Ω termination, the time-mark output of a time-marker generator to **CH 1**, as shown in Figure B–5. Set the output of the generator for 10 ms markers.

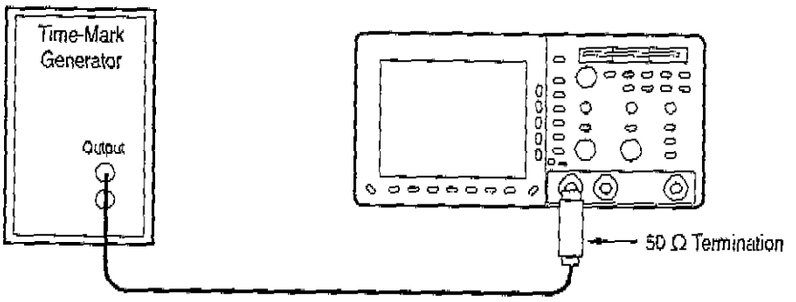

Figure B–5: Hookup for sample rate check

2. Press **SAVE/RECALL SETUP → Recall Factory Setup → OK Confirm Factory Init.**
3. Set the vertical **SCALE** to 500 mV/div.
4. Press **SET LEVEL TO 50%**; use the vertical **POSITION** knob to center the test signal on screen.
5. Set the horizontal **SCALE** to 1 ms/div.
6. Press **HORIZONTAL MENU → Trigger Position → Set to 10%.**

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7. Adjust the horizontal **POSITION** to move the trigger T to the right and on to the screen. Continue to position the trigger T to align it to the center vertical graticule line.

8. Press the main menu button **Time Base**; then press the side menu button **Delayed Only**.

9. Set the horizontal **SCALE** of the **D** (delayed) time base to 1 ms/div. Then use the **General Purpose** knob to set delay time to 10 ms.

10. Set the horizontal **SCALE** of the **D** (delayed) time base to 500 ns/div.

NOTE. *When you change the SEC/DIV in step 10, the delay time readout changes to 10.00001 or 9.99999. This is normal and has no effect on the verification*

---

11. Check that the rising edge of the marker crosses the center horizontal graticule line at a point within ±2.0 divisions of the graticule center.

NOTE. *One division of displacement from the center graticule corresponds to a 50 ppm time base error.*

---

12. Disconnect the test hookup.

Delta Time Measurement Accuracy

Delta time measurement accuracy is verified by successful completion of the previous procedure.

Trigger System Checks

These procedures check those characteristics that relate to the trigger system and are listed as checked under *Warranted Characteristics* in the *Specifications* section.

Check Edge Trigger Sensitivity, DC Coupled

Equipment Required: One leveled sine wave generator (Item 7 or 8), two precision 50 Ω coaxial cables (Item 2), one 50 Ω termination (Item 1), and one BNC T connector (Item 4).

Time Required: Approximately 10 minutes.

Prerequisites: See page B–5.

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Procedure:

1. Press **SAVE/RECALL SETUP → Recall Factory Setup → OK Confirm Factory Init.**
2. Set the vertical **SCALE** to 500 mV/div.
3. Set the horizontal **SCALE** to 10 ns/div.
4. Press **TRIGGER MENU → Mode → Normal.**
5. Press **ACQUIRE → Mode → Average 16.**
6. Connect one 50 Ω cable to the output of the sine wave generator. Attach a BNC T connector to the other end of the cable. Connect a second 50 Ω cable to the other side of the BNC T connector.
7. Connect the BNC T connector to **CH 1**; connect the cable to the **EXT TRIG** input through a 50 Ω termination as shown in Figure B–6.

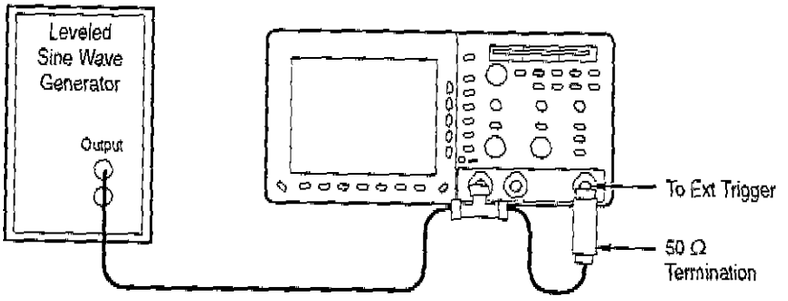

Figure B–6: Hookup for trigger sensitivity check

8. Set the generator frequency to 100 MHz (TDS 340), 200 MHz (TDS 360), or 400 MHz (TDS 380).
9. Press **MEASURE → High-Low Setup → Min-Max.**
10. Press the main menu button **Select Measurement.**
11. Press the side menu button **–more–** until **Amplitude** appears in the side menu. Press the side menu button **Amplitude.**
12. Press **SET LEVEL TO 50%.**
13. Set the test signal amplitude for about one division on screen. Fine adjust the generator output until the **CH 1 Amplitude** readout indicates the amplitude is 500 mV. (Readout may fluctuate around 500 mV.)
14. Press **TRIGGER MENU → Slope.**

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15. Press **SET LEVEL TO 50%**. Check that a stable trigger is obtained for the test waveform on both the positive and negative slopes (see Figure B–7). (Use the side menu to switch between trigger slopes; use the trigger **LEVEL** knob to stabilize the trigger if required.)

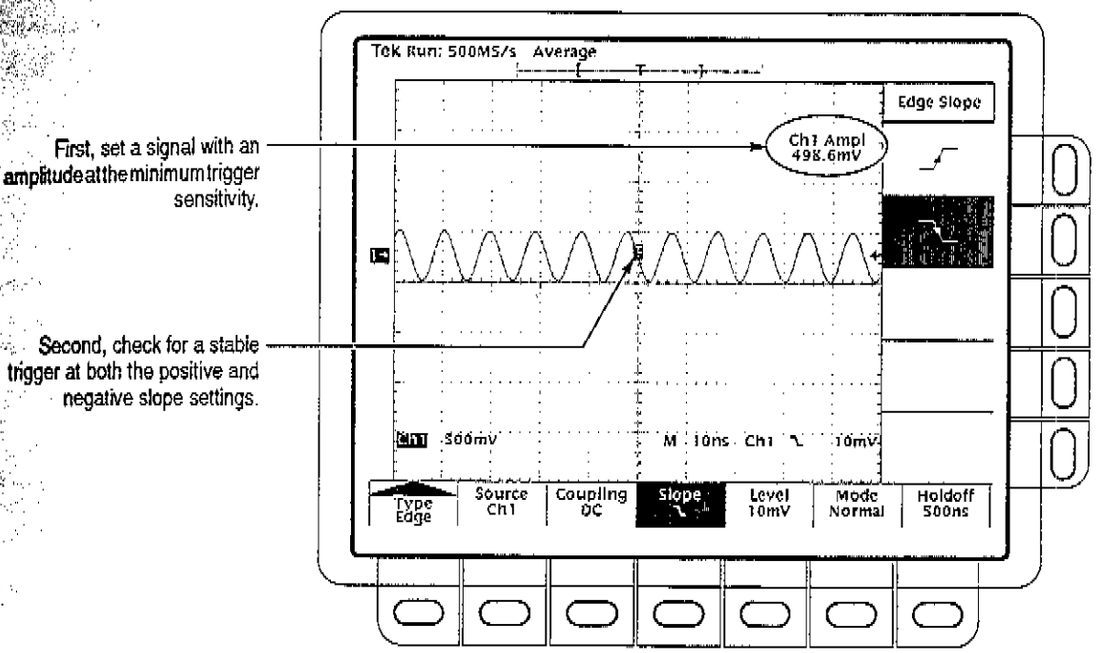

Figure B–7: Measuring trigger sensitivity

16. Press **WAVEFORM OFF**.
17. Press **CH 2**.
18. Press **TRIGGER MENU → Source → Ch2**.
19. Disconnect the hookup from **CH 1** and connect it to **CH 2**.
20. Set the vertical **SCALE** to 500 mV/div.
21. Repeat steps 14 and 15 for Channel 2.
22. Press **TRIGGER MENU → Source → EXT/10**.
23. Press **MEASURE → Select Measrmnt → Amplitude**.
24. Increase the generator amplitude until the amplitude measurement reads 1.5 V if you are checking a TDS 340 or TDS 360. Increase the generator amplitude until the amplitude measurement reads 4.0 V if you are checking a TDS 380.

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25. Repeat steps 14 and 15 for the external trigger.

26. Disconnect the test hookup.

Trigger Level Accuracy, DC Coupled

Trigger level accuracy is verified by the successful completion of the Self Tests and the DC voltage measurement accuracy procedure on page B–5.

This completes the performance verification procedure.

Sine Wave Generator Leveling Procedure

Some procedures in this manual require a sine wave generator to produce the necessary test signals. If you do not have a leveled sine wave generator, use the following procedure to level the output amplitude of your sine wave generator using a power meter.

Equipment Required: Sine wave generator, level meter and power sensor, power splitter, and one precision coaxial cable.

Time Required: About 5 minutes.

Prerequisites: See page B–5.

Procedure:

1. Connect the equipment as shown in Figure B–8.
2. Set the sine wave generator to a reference frequency of 50 kHz.
3. Adjust the sine wave generator amplitude to the required number of divisions as measured by the oscilloscope.
4. Note the reading on the level meter.
5. Change the sine wave generator to the desired new frequency.
6. Input the correction factor for the new frequency into the level meter.
7. Adjust the sine wave generator amplitude until the level meter again reads the value noted in step 4. The signal amplitude is now correctly set for the new frequency.

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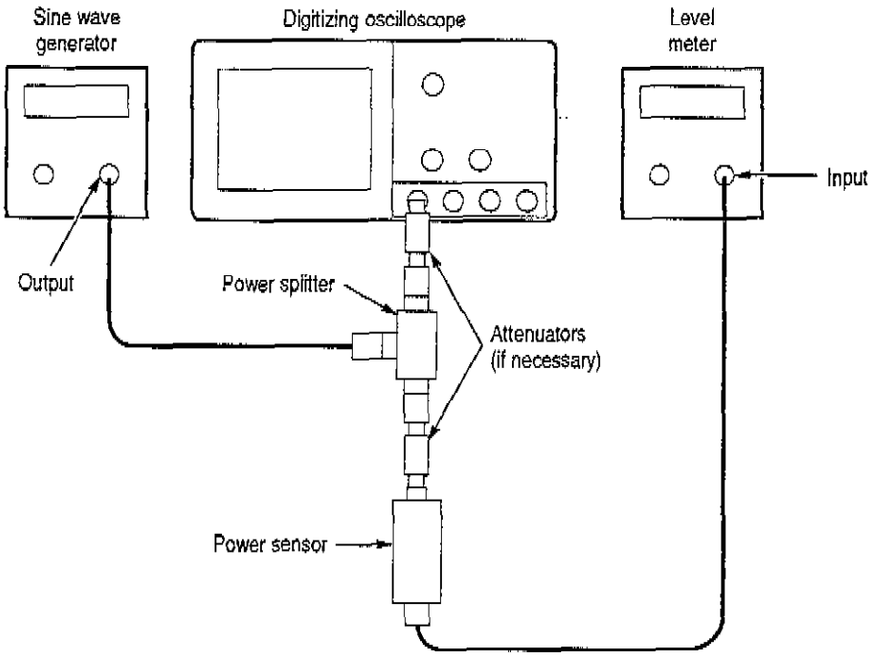

Figure B–8: Hookup for sine wave generator leveling

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Appendix C: Options and Accessories

This appendix describes the various options as well as the standard and optional accessories that are available for the TDS 340, TDS 340, and TDS 380.

Options

Options include the following.

Option 14: I/O Interfaces

This option includes GPIB, RS-232, and Centronics interfaces, VGA video output, and power for the DPU 411 printer. It also includes the *TDS 340, TDS 360 & TDS 380 Programmer Manual.*

You can connect a remote display to the VGA 9-pin D connector on the rear panel. Table C–6 on page C–4 gives the part number of a properly shielded cable that is commercially available.

Because display manufacturers use different pin combinations and connectors, you may find the information in Table C–1 helpful.

Table C–1: VGA output connector pins

Pin	Signal
2	Video (monochrome analog)
4	Horizontal sync @ 31.5 kHz (VGA rate)
5	Vertical sync
6, 7, 8	Ground

Options A1–A5: International Power Cords

Besides the standard North American, 110 V, 60 Hz power cord, Tektronix ships any of five alternate power cord configurations with the oscilloscope when ordered by the customer (see Table C–2).

Table C–2: International power cords

Option	Power Cord
A1	Universal European — 220 V, 50 Hz
A2	UK — 240 V, 50 Hz
A3	Australian — 240 V, 50 Hz

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Table C–2: International power cords (Cont.)

Option	Power Cord
A4	North American — 240 V, 60 Hz
A5	Switzerland — 220 V, 50 Hz

Language Options

Language options provide user documentation in following local languages (see Table C–3 for options and manual part numbers):

Table C–3: Language options

Language option	Language	User manual	Reference
Std	English	070-9459-XX	070-9434-XX
L1	French	070-9431-XX	
L3	German	070-9432-XX	
L4	Spanish	070-9433-XX	
L5	Japanese	070-9440-XX	070-9441-XX
L7	Simple Chinese	070-9437-XX	
L8	Standard Chinese	070-9438-XX	
L9	Korean	070-9439-XX	

Warranty-Plus Service Options

The following options add to the services available with the standard warranty. (The standard warranty appears immediately following the title page in this manual.)

- Option M2: Tektronix provides three years of warranty plus two years remedial service.
- Option M3: Tektronix provides three years of warranty plus two years remedial service and four oscilloscope calibrations.
- Option M8: Tektronix provides four calibrations and four performance verifications, one of each in the second through the fifth years of service.

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Standard Accessories

The standard accessories listed in Table C–4 come with the TDS 340, TDS 360, and TDS 380. (Refer to Table C–3 for manual part numbers.)

Table C–4: Standard accessories

Accessory
Reference
User Manual
U.S. Power Cord
Probes (quantity two) P6109B 10X Passive (TDS 340)
Probes (quantity two) P6111B 10X Passive (TDS 360)
Probes (quantity two) P6114B 10X Passive (TDS 380)

Optional Accessories

You can order the optional accessories listed in Table C–5.

Table C–5: Optional accessories

Accessory	Part number
Scope Camera	C-9, Option 4, (includes Adapter Hood 016-1154-01)
Oscilloscope Cart	K212
Rackmount Kit (for field conversion)	016-1166-00
Soft-Sided Carrying Case	016-1158-01
Carrying Case	016-0792-01
Deluxe Transit Case	016-1157-00
Front Cover	200-3232-02
Accessories Pouch	016-1159-00
I/O Interface Field Upgrade Kit	TD3F14A
Docuwave waveform capture utility software for the PC	S60 DWAV
Printer, bubble-jet, 360 dpi, 83 cps, plain paper	HC 220
Printer, portable thermal, 112 mm paper	DPU 411
Paper for DPU 411 printer, package of five rolls	006-7580-00
Programmer Manual	070-9442-XX
Service Manual	070-9435-XX

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Accessory Probes

These are other types of probes you can use with the TDS 340, TDS 360, and TDS 380. You can order the following probes separately:

- P6101B 1X Passive Probe
- P6129B Switchable 1X–10X Passive Probe (not recommended for the TDS 360 or TDS 380)
- P6408 TTL Logic Probe
- P5100 High Voltage Probe
- P5200 High-Voltage Differential Probe
- AM503S DC/AC Current Probe System
- P6561AS SMD Small-Geometry Probe

Accessory Cables

Table C–6 lists cables you can use with the TDS 340, TDS 360, and TDS 380. You can order them separately.

Table C–6: Accessory cables

Cable type	Part number
GPIB,1 meter (3.3 feet)	012-0991-01
GPIB, 2 meter (6.6 feet)	012-0991-00
RS-232, 9-pin female to 9-pin female connectors, null modem, 76 inch (for AT style computers)	012-1379-00
RS-232, 9-pin female to 25-pin female connectors, null modem, 76 inch (for PC style computers)	012-1380-00
RS-232, 9-pin female to 25-pin male connectors, null modem, 9 feet (for serial interface printers)	012-1298-00
RS-232, 9-pin female to 25-pin male connectors, 15 feet (for modems)	012-1241-00
Centronics, 25-pin male to 36-pin Centronics, 2.4 meter (8 feet) (for parallel printer interfaces)	012-1214-00
NEC® VGA video cable. (Use an appropriate adapter when other than a 9-pin monitor connection is needed.)	73893029

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Appendix D: General Care and Cleaning

General Care

Protect the oscilloscope from adverse weather conditions. The oscilloscope is not waterproof.

CAUTION. *To avoid damage to the oscilloscope, do not expose it to sprays, liquids, or solvents.*

Cleaning

Inspect the oscilloscope as often as operating conditions require. To clean the oscilloscope exterior, perform the following steps:

1. Remove loose dust on the outside of the oscilloscope with a lint-free cloth. Use care to avoid scratching the clear plastic display filter.
2. Use a soft cloth or paper towel dampened with water to clean the oscilloscope. You can use a 75% isopropyl alcohol solution for more efficient cleaning.

CAUTION. *To avoid damage to the surface of the oscilloscope, do not use any abrasive or chemical cleaning agents.*

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